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# The ELECTRICAL REVIEW

FOUNDED 1872

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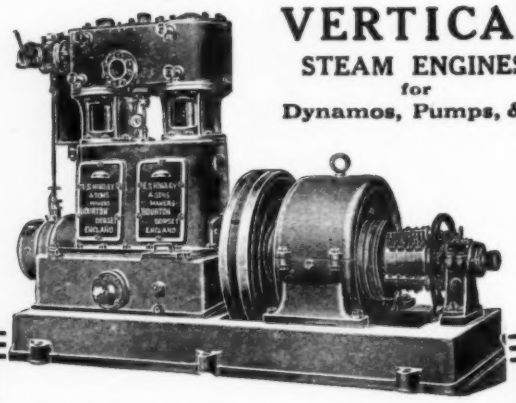

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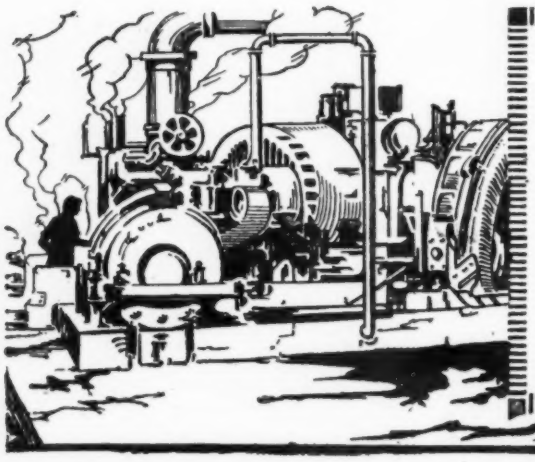

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# Electrical Review

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# Domestic Electrical Appliances.

EXCEPTIONAL interest was taken in the discussion on "Troubles Experienced with Domestic Electrical Appliances," which was opened by Mr. J. W. Beauchamp at the Informal Meeting of the Institution of Electrical Engineers on January 7th. The subject is of peculiar importance in view of the rapidly extending adoption of electricity as an aid to the housewife and an invaluable addition to the amenities of the home, and numerous speakers related their experiences and expressed their views during a lively debate. The opener dealt with the matter rather broadly, with an eye to "electrical development," and laid stress on the principle of service, but every conceivable aspect of the subject appeared to be touched upon by one or other of the speakers who followed him.

We do not propose to refer in detail to the various ills which electrical appliances, like human beings, are inherently liable to suffer from; fortunately, the faults that occur nowadays are very few compared with those that happened in pre-war days. But certain considerations arising out of the discussion and our own experience, more or less relevant to the matter, may not be out of place.

Every household appliance, whether associated with water, gas, electricity, or even coal, is liable to develop a fault at some time or other, necessitating the services of a craftsman. Suppliers of water and gas in many cases undertake to maintain in good order the apparatus connected with their services for a small quarterly charge, but more usually it falls to the lot of the man—or woman—of the house to effect the necessary repairs, more or less efficiently, if the damage is of a simple nature and lies outside the pipes. If, however, the pipes are affected, the householder must have recourse to the plumber or gasfitter, and congratulates himself if he escapes without financial disaster. In the case of electrical apparatus the conditions are very different; there is no sensible fluid to escape from the conductors, and the temptation to attempt not only such obviously simple feats as the replacement of a lamp, but also repairs to the actual conductors, such as flexible cords,

is to many irresistible, whilst the dark suspicion that the electrical contractor will out-Herod Herod is a strong deterrent to seeking his aid. Fortunately the consequences of a bungling performance of this nature are less serious with electricity than they would be with gas or water; fuses are provided to guard against all faults, whether due to accident or to misguided amateurs, and in spite of their drawbacks they do their duty very efficiently.

Even here, however, there is a loophole for untutored ingenuity; the amateur may nullify the value of the fuse by rewiring it with a hairpin or some other unsuitable material.

An alternative course is to abandon the use of the defective article and make shift with some substitute—a procedure which not only stultifies the investment in wiring and appliances, but also deprives the electricity supplier of an outlet for energy and incidentally tends to bring electrical methods into discredit.

Short of educating every consumer in the art of the electrician—an impossible task—there is but one way of satisfactorily dealing with this matter, and that is the way advocated by Mr. Beauchamp and by other speakers—namely, the provision of an adequate maintenance service. In the ordinary course, an electrical contractor, having installed the wiring and fittings in a house, promptly forgets its existence and never enters it again unless he is summoned by the occupier. He thinks—possibly he knows—that it would not pay him to institute a system of periodical house-to-house visitation to see whether anything is amiss which he can put right at small cost to the customer, and apart from payment for the labour and material involved, he has no further interest in such a transaction. But the supply authority stands in a very different position. In its case the cost of visiting the consumer and repairing a fault is trifling compared with the continuing loss that it suffers from the disuse of an appliance that would otherwise consume several kilowatt-hours a week, mostly off the peak and therefore a highly profitable source of revenue. Moreover, since electricity in the home, apart from lighting, is still comparatively new to the majority of householders, its behaviour is subject to the closest scrutiny and to the ordeal of feminine criticism, which, when applied to any device that has not been familiarised by generations of use, is apt to be as caustic as it is unexpected. Hence it is very desirable to bear in mind the psychological effect of periodical inspection of domestic electrical appliances by an affable and helpful representative of the supply authority, armed with a pair of pliers and a screwdriver, who in most cases could attend to such matters—trifling in themselves, but irritating to the housewife—as the repair of a worn flexible or the rewiring of a fuse, in a few minutes. The confidence instilled and the satisfaction created by such a service would alone be worth the cost—for these qualities are the most effective "business-getters" imaginable—but the increased output of energy resulting not only from the continued use of existing appliances, but also from the purchase of additional ones, would repay the cost tenfold or a hundredfold. Countless users of electric light are unaware that they can boil a kettle, heat an iron, or run a suction cleaner from the lighting leads without spending a penny on new wiring; and many of those who use electricity for these purposes are ignorant of the innumerable other applications to which it can be put. Tactful suggestions by the maintenance man would open the eyes of such consumers to the possibilities available to them, and would result in many additions to the consuming devices installed.

Where such a service, or even an approximation to it, in the form of a readiness to give such service at a moment's notice, is in force, the effect upon the mental attitude of the consumer is most gratifying. Nothing is perfect yet—not even domestic electrical apparatus, though that is vastly better than it used to be—but an efficient maintenance service turns latent hostility into active friendship, and is a most potent means of developing the use of electricity. The gas suppliers are giving close attention to the subject in their own sphere, which more and more tends to become heating rather than lighting; in order to compete with them and to give the electrical equipment an equal opportunity to display its unquestionable superiority, the institution of efficient maintenance by electricity suppliers is an urgent necessity.

Before leaving the subject, having referred to contractors and suppliers, we would have a word with the manufacturers. Why don't they get women to design their apparatus? Most of them are used by women, who are not tolerant of crudities, and are quick to institute comparisons. Makers of gas cookers seem to have learnt that lesson, and endeavour to render their apparatus as easy to operate as possible. We could write much more on this subject than we can spare space for, but to put the matter briefly, we would say: abolish all thumbscrews—women hate screws and nuts—and adopt other means for quickly fixing parts, such as the shelves of ovens, the fittings of suction cleaners, &c.; avoid sharp corners which abrade the skin, interior angles which are difficult to clean, and sharp edges which cut and tear; use stainless steel for the tops of cookers; fit longer flexibles to radiators and irons, and provide stowing hooks on the former; make plugs interchangeable; and try every new design under varied working conditions in the hands of unskilled users. Many defects that we have observed in electrical appliances appear to have been put there in the drawing office, by designers who have not the faintest idea of what a woman's work consists in, or of the point of view that she will take.

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**Oversea Visitors to the Exhibition: A Matter of Urgency.**

On various occasions during the past year we have made suggestions with a view to securing the presence of a large number of oversea electrical engineers and electrical buyers at the British Empire Exhibition. We have endeavoured to convince all Colonial and foreign electrical and allied men that a warm welcome will await them on their arrival on these shores. Many of them are members of the electrical or other engineering institutions, and have received special invitations; others are known to oversea representatives of British electrical companies and firms who will pay regard to their interests while here; others will receive attention through the medium of the B.E.A.M.A. and its staff either at the London headquarters or at its office at the Exhibition; and during the World Power Conference by invitation of the committee of that great gathering large numbers of gentlemen representing all sections of engineering activity will have abundant opportunities for fraternisation and appropriate entertainment. In case there may be some who do not come in any of the foregoing categories, we renew our own invitation to readers to acquaint the ELECTRICAL REVIEW at an early date with their intentions and desires so that our "Service Department" may be able to afford them information and assistance.

The subject is mentioned in our pages this week by a correspondent (Mr. E. T. Williams) who has had a good deal of experience overseas and is anxious that no occasion should arise for a visitor to feel lost among the vast multitude at Wembley or to be deprived of any facilities which should make his visit Home a profitable one. We believe it is perfectly safe to say, though the detailed arrangements that are being made by the various organisations cannot yet be published, that steps are being taken which ought to be effective for every class of visitor immediately he arrives here and makes himself known. Naturally enough, however, there are many oversea engineers who would like to know the complete story of the arrangements that are being made on their behalf. They would like to know it soon, for we are already in Exhibition year. In a few months the Exhibition should be in full swing, and some parts of the world take a month and more to reach

by mail. For the benefit of those who may be leaving for England before the full details reach them, we may say that these will be in our possession by the time of their arrival, and we shall be glad to lend them any assistance that lies in our power.

While we are satisfied that a great deal will be, perhaps is being, done, we cannot help feeling that certain important connecting links are missing. Overlapping of effort may not matter much in this case, but divided effort is hardly a sign of strength, and as we judge the position there is room for a sort of co-operative Welcome Committee. It appears that according to present plans somebody will look after somebody else for a part of the time, but with a six months' exhibition what we need is somebody who will be authorised and qualified to look after anybody electrical or allied who arrives during the whole period. Cannot this be assured in some way or other without delay? Is there nobody who will take the initiative and secure unity of action at once?

---

**Russia and the Utilisation of Foreign Technical Experience.**

A REPORT from Moscow announces that the leaders of the two heavy electrical engineering trusts have returned from abroad. The object of their travels was the establishment of technical connections with foreign works—in general, German and American undertakings—so as to provide for an exchange of drawings and projects and at the same time to arrange for the dispatch of Russian specialists to foreign works and *vice versa*. It is hoped in this manner to afford Russian engineers an opportunity of making themselves acquainted with the details of all processes and secrets of production at the works with which a connection is established, both in the works and the laboratories. The co-operation in this way is expected to result in the introduction into the Russian manufacturing works of those branches of production which are now lacking, namely, high-voltage transformers, high-pressure switchgear, turbo-generators, &c. It is considered that co-operation will also tend to bring about economy in manufacturing at the Russian works, where the cost of production of many articles is as much as four times what it is abroad. It is further stated that the representatives of the two trusts have taken back with them practical proposals from big foreign firms, and these are to be examined by competent Russian authorities.

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**The Electrification of France.**

THE President of the Republic has signed a decree creating, in connection with the Ministry of Public Works, a commission for the purpose of studying a general programme for the electrification of the country and the administrative and financial means which are necessary for its realisation. In the course of a report submitted to the President, by M. Yves Le Trocquer, Minister of Public Works, it is pointed out to be of the highest importance that the new works projected should not be conceived and carried out solely from the standpoint of private or purely local interests. The possibility of transmitting energy over long distances has deprived electrical undertakings of the regional character which applied to them until recent times. The problem of the development of the electrical installations in reality is a national matter from both the technical and the economic points of view; and the logical solution can only be sought for in a general study of the requirements and the means of satisfying them—a study which will permit of establishing a general programme of production and transmission extending over the whole of France.

The report of the Minister proceeds to state that the general programme will have to be prepared by taking into consideration the needs to be provided for in the course of the next six to twenty years, so that the realisation will only be of a gradual character. As is well known, a scheme of converting the railways to electric traction has already been established, together with a project of large transmission networks which are to connect the various sources of energy and place them at the service of all parts of the country. An inventory has also been made of hydro-electric works which it is rational to equip in order to provide against the deficit in the French production of coal. The question now is to bring to light and co-ordinate the results obtained on these different points so as to be able to prepare a general plan of electrification. These investigations would be inadequate if they were not complemented by taking the administrative and financial measures which are necessary for the co-ordination and seconding of private initiative with the object of carrying out the programme established in this manner. It is all these considerations, then, which have promoted the creation of a special commission to bring the matter to a successful issue.

The Commission is to be composed of equal numbers of representatives of the Ministries which are interested on the one hand, and on the other representatives of the industries which co-operate in the generation, transmission and distribution of electricity. The former will include representatives of the Ministries of Public Works, Finance, Agriculture, War, and Commerce. In the latter case there will be representatives of the Union des Syndicats de l'Electricité, the Chambre Syndicale des Forces Hydrauliques, the Syndicat Professionnel des Producteurs et Distributeurs d'Energie; three representatives of the electrical manufacturing firms, and representatives of the railways.

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**Technical Losses in the Japanese Disaster.**

THE first reports of the Japanese earthquakes and fires came to everybody as a shock, because of the horror and the appalling loss of the whole disaster. Immediately, there was a spontaneous expression of sympathy, and a practical response from all parts of the world, sending assistance to those who were in urgent need. But it is in the later reports that reach one through personal correspondence and through the Japanese Press that one comes closely into touch with some of the consequences of the calamity, for those who escaped with their lives. Letters have reached us from certain British residents for whom recent experiences mean practically starting life over again when retirement was due. Other communications are of a less personal nature, and show that electrical and other scientists of Japanese nationality are likely to experience great inconvenience in the pursuit of their studies and avocations unless help from other scientific nations comes to their aid. One case that may be cited is the destruction of all the presses and equipment of the University of Siudai, which brought to an abrupt end the production of a series of medical and biological journals under order by the Japanese Government. Arrangements have been made for the setting up of a special plant in America (at the Wister Institute, Philadelphia) where the production of the journals will be proceeded with. Amongst the other sufferers there is one whose loss will, we are sure, call forth immediate assistance from electrical men in this and other countries—we refer to the destruction of the library, at Tokio, of the Institution of Electrical Engineers of Japan. Our Japanese *confrères* have long been assiduous students of Western electro-technical literature, whether in the form of books or periodical publications, and we are sure that it will be the wish of those who have it in their power to help, to see the new Tokio library shelves provided with up-to-date and efficient substitutes for the works that have been lost.

Disaster upon disaster seems to be the fate of Japan, for since the foregoing was written, the Imperial University at Fukuoka, including the Engineering College, has been destroyed by fire, the loss being £500,000; and what seems to be even worse than that, further more or less serious earthquakes occurred over a very wide area early on Tuesday morning.

D

# The Position of the Colliery Engineer.

In our issue of December 14th last, when dealing with electrical accidents in mines, we made the suggestion that these might be prevented to a great extent by placing the whole of the mechanical and electrical equipment and the workmen operating it under the charge of a thoroughly trained, qualified, and certificated engineer. For the reader thoroughly to understand the situation, we should explain that under the Coal Mines Regulation Act every colliery must be under the management of a certificated colliery manager, who shall be responsible for the "control, management, and direction of the mine." To obtain a certificate, a candidate must present himself to the Board for Mining Examinations for examination, and the certificate is granted by the Secretary for Mines on the Board's recommendations.

There are two certificates, viz., 1st class and 2nd class certificates of competency, and candidates for either must produce:—

1. A first-aid certificate of the St. John Ambulance or the St. Andrew's Ambulance Association or other society or body approved by the Secretary for Mines, and (2) a firemen's certificate as required under section 15 of the Coal Mines Act, 1911. He also "shall have had practical experience in mining for a period of not less *than five years*, or in the case of a candidate who has received an approved diploma or taken an approved degree, of not less than three years, and the nature of the practical experience shall be gained in one or other of the following capacities:—

(*a*) As a fireman, deputy, or examiner, or other underground official of a mine, or as an underground workman in a mine, provided he has had direct practical experience in the work of getting minerals, and of stone work, timbering, and repairing. A mine surveyor will not be regarded as an underground official for the purpose of this rule.

(*b*) As a mining apprentice or mining student, provided he has been engaged for more than half of the five years or three years as the case may be:—

(1) In actual practical work at the working face and other parts of the underground workings of the mine, or

(2) In direct supervision and direction of such work. He must have such a knowledge of arithmetic, mathematics, physics (including electricity), chemistry, geology, and engineering science as will enable him to answer properly questions in the following subjects:—

(1) Winning and working minerals; (2) theory and practice of ventilation; (3) explosions in mines, underground fires, and inundations, their causes and prevention; (4) machinery; (5) surveying, levelling, and drawing; (6) general management and mining legislation.

In addition to the first- and second-class certificates of competency for colliery managers, there is also the surveyor's certificate, the mines inspectors' examination, and the fireman's certificate. As the last-named was mentioned by one of our correspondents, we may mention that a full certificate for a fireman certifies three things:

1. That he can test for gas with a safety lamp.
2. That he can measure an air current.
3. That his hearing is good.

He must be 25 years of age and have had at least five years' experience underground, two years of which shall have been at the working face. So much then for the mining official certificates of competency.

Now we would ask: Is it humanly possible, even for a man with a super-brain, to be an expert in mining engineering, mechanical and electrical engineering, a geologist, a chemist, and at the same time have a legal knowledge of all that the Mines Regulation Act contains and portends?

We have on several occasions said it is impossible; at the best a certificated colliery manager can only have a small general knowledge of mechanical and electrical engineering, and depends upon the skill and knowledge of manufacturing engineers to a very great extent for both guidance and responsibility. The demands on his time during his mining training forbid anything else. On this point we should like to refer our readers to the remarks of Mr. Samuel Hare, O.B.E., M.Inst.C.E., in his presidential address to the North of England Institute of Mining and Mechanical Engineers on October 13th, 1923. In this he said: "In my opinion one of the most important items that requires to be considered in connection with the prevention of accidents in our mines is the training of the managers of these mines"; and in referring to the "Mines Examination Board" he said: "The object aimed at by the Board has been to raise the standard of the examinations to the highest possible degree, without inflicting unnecessary hardships upon the candidates. . . In drawing up the rules with respect to the qualifications of the candidates, and in fixing the proportion of marks, &c., in connection with the examinations, it is only natural that the workmen's representatives should have always insisted that due regard must be paid to the necessity for every candidate for first- and second-class certificates having had sufficient practical experience in and about the face where most of the accidents happen, as the lives of the workmen whom they represent are at stake. They have always claimed that the examination in certain subjects, such as surveying and *mechanical engineering, should be of such a character as to give a working miner or under official a reasonable chance of passing in these subjects.*" (The italics are ours.)

On the other hand, the representatives of the owners, agents, and managers, while admitting that a reasonable amount of experience in or about the face in practical work or in direct charge of such work is essential, have insisted that other experience in connection with surveying and planning, mechanical and electrical engineering, shaft-sinking, &c., "is just as necessary." Mr. Hare also said: "It is obvious that if the use of electricity underground and blasting were prohibited (which would be just as ridiculous as to prohibit ships from going to sea in rough weather, or to prohibit express trains from running), *the number of accidents would be reduced*; but by doing so, or by making the conditions under which they can continue to be used too onerous, the result will undoubtedly be that it will be absolutely impossible to work on a commercial basis large areas of valuable coal in this country." Instead of this, however, Mr. Hare suggests that "The use of electricity underground should be largely extended," and advocates the scrapping of obsolete steam boilers and the installation of up-to-date water-tube boilers, and mixed-pressure turbines driven principally by exhaust steam which would otherwise be wasted.

From this we see how much a modern colliery depends upon the equipment and management of mechanical and electrical plant, and we have examined the training of the colliery manager who is held fully responsible for its installation and working. Now we would ask: Would any railway company allow or expect the traffic manager to buy and operate and be responsible for the locomotives on the line?

As is well known, a highly trained engineer is in charge of the locomotive department, who is responsible not only for the design and suitability of the engines for the work, but also for the maintenance, manning, and running. Likewise in colliery working, we maintain that it would be for the benefit of all concerned to divide the responsibility of colliery management between the underground manager and the engineer. The former would be trained as he is at present, the latter would be trained in mechanical and electrical engineering as applied to mines, and certificates and diplomas and degrees of equal value should be available for each. The engineer would take full charge of the mechanical and electrical equipment, the men in charge of it and its

operation, and would be held responsible under the Coal Mines Act for its maintenance and the prevention of accidents. The agent or general manager might be appointed from either branch as the owner or directors of the company thought desirable.

This would at once give an impetus to students interested in mining mechanical and electrical work, their status and position would be raised, ambition at present lacking would be fostered, and in course of time there would be a type of engineer available who to-day is scarcely to be found. Before the days of certificates, the chief engineer of a colliery was responsible to the agent or owners and independent of the viewer or manager—and even to-day the owners or agent find it desirable to put the engineering side in the hands of an independent engineer. This arrangement, however, seldom or never works smoothly, and there is always more or less friction set up. Under the law, the manager is responsible, and so long as he has to carry the responsibility he is inclined to interfere.

In October last, before the Midland Institute of Mining, Civil and Mechanical Engineers, Sir William Ellis, G.B.E., a vice-president of the Institution of Civil Engineers, in a paper on "The Position of Mechanical Engineering in Colliery Operations," pleaded that "the mechanical engineer of a more technical and wider training should be included amongst the staff of a colliery, and that he should have *given him a status higher* than has previously been the custom" (the italics are ours), and though Sir William did not go as far as we have done in suggesting that such engineers should also have certificates of competency under the Coal Mines Act, we feel sure he would be the first to agree with our suggestion. In the course of his paper he said: "Although I admit that a great deal has been done in improving colliery plant, it cannot be admitted that engineering science has reached the same high level, in its application to the mining industry, as it has in either shipbuilding or electric power production. I attribute this fact partly to the inability of the mining engineer to give sufficient time and thought to this side of his work, and partly to the fact that mechanical engineering in a colliery must always, and rightly so, take a second place, compared with the mining engineering side of the work for which the colliery actually exists." In the following discussion the President (Mr. John Brass) asked: "Where will we find the mechanical engineer that Sir William Ellis has in mind? I am sure that even at a large group of collieries, if such a man was required, there would be very great difficulty in obtaining him, because he must have his training at a colliery and under the auspices of a mining engineer." Sir Richard Redmayne took the comparison between a colliery and a steamship as we ourselves have done before, and said: "The case of a group of collieries, or that of a large colliery, is to my mind very similar to that of a large vessel. There we have the captain responsible for the general and proper conduct of the vessel, but he has on board a very highly trained engineer who is responsible within certain limits for the engineering conduct of the vessel." Prof. Douglas Hay (Sheffield University) referring to the relative positions of the mechanical engineer and the colliery manager, said: "This is a very difficult question to decide, and is rendered all the more so by the provisions of the Coal Mines Act, 1911, which appears to have been drawn up without any contemplation of the position which has now arisen, owing to the advent of so many large collieries where there is room for a mechanical engineer of considerable standing and knowledge. The Act throws the whole responsibility for the mining and mechanical engineering of a colliery on to the colliery manager, and the colliery manager, realising this, is rather loath to delegate authority to a mechanical engineer who has no responsibility under the Act." This creates a false situation that could not be foreseen by the framers of the Act. Of course, at a large modern colliery the agent really carries out the responsibilities and duties which the Act states should be taken by the manager, and the manager himself has rather developed into an underground manager of collateral standing with the mechanical engineer. This creates a position which is not easy for either, even with the greatest goodwill in the world.

We are in full agreement with Professor Hay, and suggest to him and others interested in the mining industry that the difficulties can be removed, the efficiency of the plant increased, accidents prevented, costs reduced, and profits increased by giving the man in charge of the mechanical side the position and status due to him, and that can only be done by giving him the responsibility under the Act. Train and educate these men in the colleges and at the collieries in the same way as the colliery manager is trained, and if necessary have a first- and a second-class certificate; the second-class men could be appointed to the small colliery and work under the first-class engineer at the large colliery. In the discussion, one of the greatest objections that Sir William Ellis had to meet was the question of salary. It was suggested that such a man would require too big a salary. Certainly he would want a salary commensurate with his position, and his ability and responsibility, and, as Sir William in his reply to this point said, the mining engineers would be the very first to realise the value of the services rendered by them through suggesting economies that could not fail to result very favourably to their directors, and we are certain such a man would save more than his salary many times over.

It is true, of course, that in the foregoing no question of granting certificates of competency was raised; so far as we are aware, no one outside ourselves has ever publicly raised the question, and it may be asked why should *certificated* engineers be required? In reply we may ask why should the colliery manager be certificated? Why should the fireman be certificated? Why should it be necessary to have certificated officers in a steamship? The Government of this country instituted all of them with one object, and that is what we are now striving for—the prevention of accidents and loss of life, as well as damage to property. We have stated our views and our reasons for them, and it now remains for someone else to take the initiative and press the matter upon the Mines Department; we also sincerely believe that we are voicing the desire of every colliery mechanical and electrical engineer in this country, most of whom, owing to their position, are unable to express it themselves.

Now, as regard our remarks on the Association of Mining Electrical Engineers, we quite agree with our correspondents that it has filled a useful place in the development of the use of electricity in mines, but all the same, the original promoters had as their main object, the purpose of settling the question of responsibility, and raising the status of the engineers on the lines we have suggested in the foregoing. But what happened? Electrical manufacturers anxious to learn about colliery operations put up their agents and representatives as members; colliery managers anxious to learn about electrical apparatus also joined, and thus the original object was stifled. As one colliery manager said: "We soon put an end to that." We agree with the president that a great improvement has taken place during the last few years, and no doubt much of it has been due to the work of the Association. But we would ask him—if he ever knew—why the original intention was dropped? and more: Do you propose as a body to support it now? There is no need to make it a "Trade Union," as Mr. Martin suggests. There is a "Colliery Managers' Association," but it would be the last to suggest that it was a "Trade Union"; the Association, however, protects the position and rights of the members. We also said that the majority of men who ought to be its main supporters were conspicuous by their absence, and with all respect to Mr. Martin—we in fact can heartily congratulate his branch, as also Mr. Stretton's branch—as the president admitted, there are only 2,000 members, whilst there are some 3,000 collieries alone, and we know that some members are colliery managers, while others are manufacturers' representatives. We should like to see the control and direction of the Association absolutely in the hands of the engineers who are engaged at the collieries and in

charge of the plant, and at least one member from each colliery.

Mr. Muirhead asked how the granting of certificates would lead to the reduction of accidents, and referred to the "Fireman's certificates." Surely, he would not place the certificated colliery engineer—even a second class one—on a level with a "Fireman's certificate!" We have already dealt with his question to some extent, but would say further that trained and certificated engineers would be much better judges of the *competency* of the men in charge of the plant, such as coal cutting machinery and haulage machines, and the men responsible for their repair and maintenance, than the colliery manager with his more or less limited knowledge of engineering science. "M.E.B." hit the nail on the head, and with all due respect to the reply of "Questionable Intelligence," there are many so-called electricians in charge of plant who ought not to be, and who would not be, if they were under the control and direction of a thoroughly trained and qualified man.

# On Testing Ceiling Fans.

By REGINALD O. KAPP, B.Sc., A.M.I.E.E.

THE purpose of a ceiling fan is to give a gentle draught, and one of the principal points in which the user of the fan is interested is that this draught shall be as great as possible and of the right kind. The other matters of importance with regard to a ceiling fan, such as current consumption, noiselessness, speed regulation, power factor in the case of a.c. fans, ready starting, small weight, pleasing appearance, robust construction, durability, ability to run without attention, and so forth, can be easily tested or examined; but the degree of the fan's ability to perform the function for which it is made, that is, to give a breeze, is not at all easy to test, and the user's observations, unaided by measuring instruments, can be nothing but a most unreliable subjective impression.

The requirements with regard to the draught given by a ceiling fan are not only that as much air should be moved per minute as possible, but also that the draught should be a gentle one, and should reach as many parts as possible of the room in which the fan is installed. A fan which gave a sharp draught vertically downwards on to the user's writing table would only disturb his papers and his temper, and do little towards making a tropical climate more bearable. Therefore, the volume of air moved per minute should be great, the speed should be low, and, following from these two requirements, the cone of displaced air should have a wide angle.

One of the difficulties in determining the ability of any individual fan to meet these requirements is that the output of the same fan may differ very greatly in different rooms. The breeze set up by the fan gradually sets the whole of the air in the room in motion, and when this has taken place, the inertia of the moving air helps the fan so that its output and its current consumption fall. This circulation of air differs for different rooms, as it depends on the shape and height of the room and the height of the fan. The breeze given by the fan is also broken up, deflected, and reflected by any furniture there may be in the room. It is very different according to whether a window or a door be open or closed, or whether other fans be running or not.

It has been found that the positions of one or two bulky objects in a room greatly affect the shape of the cone of air displaced by a fan and the total fan output.

For these reasons it is only possible to form an opinion as to the relative outputs of different types of fans of different shapes and curvatures of blades, &c., if all the tests are conducted under identical conditions. The output of aeroplane propellers is tested by running the propeller in a shaft and measuring the velocity of the air displaced in this shaft. It would appear at first sight, therefore, that the same procedure could be adopted with ceiling fans. The ceiling fan could be surrounded by a cylinder open at both ends, and the velocity of the air moved in the cylinder multiplied by the area of the cylinder would give the volume of air moved in unit time. The writer found, however, that such an arrangement was far from giving the required result. There is a very important difference between the condi-

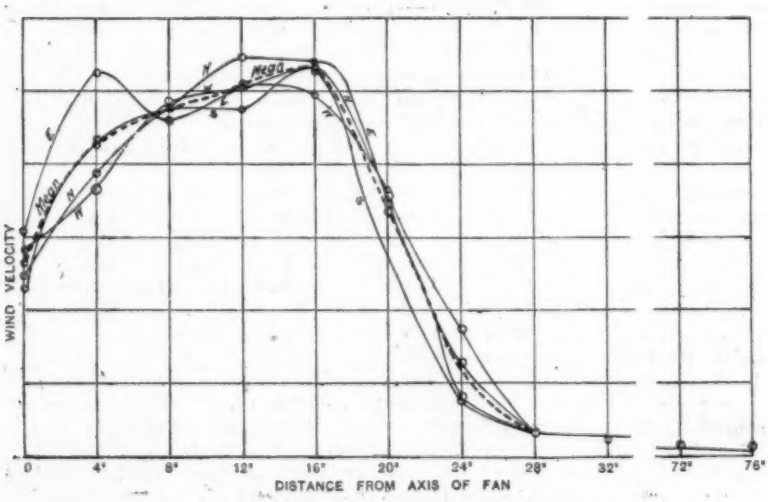


FIG. 1.—OUTPUT CURVES OF FAN HAVING 54-INCH SWEEP.

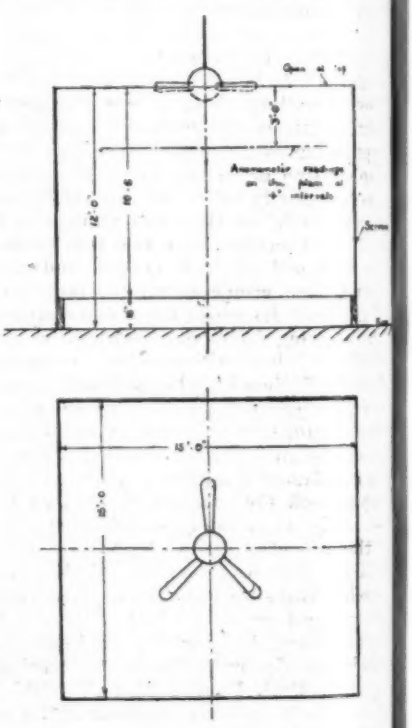

FIG. 2.—ARRANGEMENT OF SCREEN.

tions of aeroplane propellers and ceiling fans. The aeroplane propeller runs at a very high speed. It imparts a considerable pressure to the air, and can, therefore, send it through the shaft at a high velocity. The ceiling fan, on the other hand, rotates at a low speed of the order of 200 revolutions per minute. It is designed to move as much air as possible, and to move this air gently. It is found, therefore, that when rotating in a cylinder open at both ends, the blades of the fan do not exert sufficient pressure on the air to force much of it out of the cylinder. Instead, the fan blades carry round with them the air which is in the cylinder. Such pressure as is given to the air is due to centrifugal force, causing a certain amount of air to be forced out at the periphery, and to be sucked inwards at the centre. This device, in fact, operates in a manner analogous to a centrifugal pump, of which the outlet valve is nearly closed; the fan rotating inside the cylinder displaces very little air, and takes very little power. Moreover, tested in this way, a fan with blades designed to give the widest angle distribution, that is, the best type of fan, would impart to the air the greatest radial and the least downward pressure. It would show worse results, therefore, when tested inside the cylinder than an undesirable type of fan with blades designed to give a strong draught vertically downwards.

It has been found that a satisfactory arrangement for testing ceiling fans is to test them in a space formed by four vertical walls placed in a high laboratory or workshop, where the effect of the height of the ceiling is eliminated. In order to eliminate the effect of the air circulation set up within an enclosed space, the four vertical walls should not meet the floor, and it has been found that if about 18 inches are left between the floor and the bottom of these walls, there is ample space for the air displaced by the fan to get away, except in the case of blades having a very wide-angle cone, for which 2 ft. would probably be a better dimension. With such an arrangement, there are no traces of upward draught along the walls, as there always are in an ordinary room when a ceiling fan is running. The fan is always obtaining a supply of new air, and the performances of different fans can be directly compared. Fig. 2 shows the dimensions of screening which have been found to give consistent and comparable results, and it is found that practically all the air displaced by the fan escapes underneath the screens in a layer not more than a few inches thick.

It is important that for all tests the height of the fan should be exactly the same, and the anemometer should also be fixed at exactly the same height. On account of the very low velocity of a great amount of the air displaced by a ceiling fan, a very delicate and accurate anemometer is necessary, and it is important that the instrument should respond to the faintest movements of air, much fainter than any that can be felt. With such an instrument the least knock may affect its reading, and it is, therefore, advisable to take a calibration curve of the instrument before starting the test.

One might expect that a ceiling fan, being a symmetrical piece of apparatus, would create a cone of draught of which the intensity was the same for all points on the periphery of any circle concentric with its axis formed by the intersection of the cone with a plane at right angles to the axis. This, however, does not appear to be the case. It seems more probable that the air is displaced in the form of spiral bands of greater and lesser velocity and, therefore, a test of the output of a fan should take into account the average of the readings along four horizontal lines at right angles to each other, which might be labelled East, South, West, North, each starting from a point vertically below the centre of the fan. It is found that it is sufficiently accurate if readings are taken at intervals of four inches.

Typical fan curves are given in fig. 1. In all fans the wind velocity immediately beneath the centre of the fan is comparatively low, and the dip in the output curve at a little distance from the centre is general. It will be seen that this dip occurs at a different distance when the wind velocity is measured along different points of the compass, suggesting the spiral bands of greater and less intensity alluded to above. Immediately below the axis of the fan, all the curves ought, of course, to give the same result, as the four lines meet at this point. It is probable, however, that the axis of the cone of draught does not remain quite vertical. Very small disturbances would suffice to displace this axis, and it should be noted from the figure that a displacement of any of the curves by about an inch to the right or to the left would be sufficient to make them coincide on the zero line.

# Electrical Apparatus for the Deaf.

By CHARLES M. R. BALBI, A.C.G.I., A.M.I.E.E.

THIS article leads up to a description of certain electrical appliances for aiding the "deaf," after a survey of the physical and anatomical properties which are connected with the sense of hearing.

### Introduction.

Deafness may be defined as sub-normal hearing; its causes are numerous, but may be divided under two heads—

(*a*) Deafness of the outer and middle ear.
(*b*) Deafness of the inner ear.

The first case is curable, and it is fortunate that at least 90 per cent. of the cases of deafness can be covered under this heading. The second case is incurable for reasons that will be seen later.

The nature of hearing depends upon the character of sound and the physical properties of the ear.

As each of the above subjects has such an important bearing on the design of any electrical apparatus for the deaf, I give as an introduction a brief *résumé* of both.

### The Character of Sound.

1. Sound is said to have (1) frequency; (2) amplitude; (3) timbre. The term frequency is applied to the fundamental period of any sustained sound.

Amplitude may be regarded as the difference in pressure in dynes/sq. cm. between the compressions and rarefactions as they strike the diaphragm or tympanum of the ear.

Timbre refers to the number of overtones or harmonics and their respective amplitudes that are combined in a

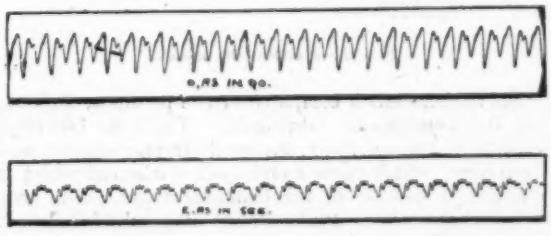

FIG. 1.—THE SOUNDS "O" AND "E."

fundamental and is of great importance, as by its means characteristic sounds are recognised. In dealing with timbre it is necessary to refer to the classic work of Fourier, in which he showed that any periodic wave form may be analysed into a fundamental and har-

monics of different orders as this analytical process takes place within the ear.

The wave shapes of different sounds are now well known; the two illustrated were taken by Mr. J. T. Irwin by means of his optiphone (see fig. 1).

The relation between the phase of a fundamental and its harmonics with regard to hearing has no discernible effect, as will be seen from certain considerations given later.

**The Physical Properties of the Ear.**

The ear is composed of three parts—

Outer, middle, inner.

The outer ear includes the auricle and the external auditory meatus, as shown in fig. 2.

The middle ear is a small cavity in the bone filled with air. Its outer wall is formed by the tympanic

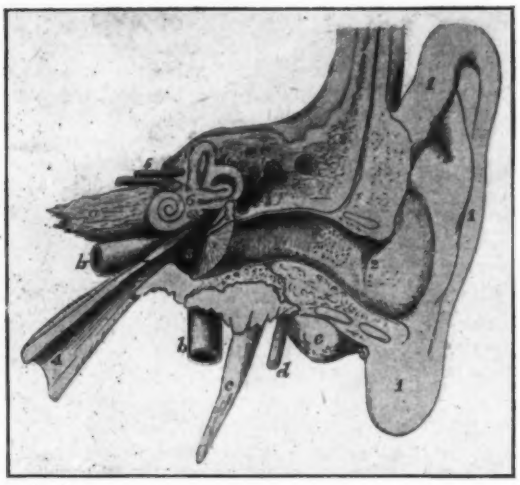

FIG. 2.—SECTION OF THE HUMAN EAR.

membrane, which is oval in shape and slopes so as to form an angle of 45 deg. with the floor of the external meatus. The inner wall separates the middle from the inner ear. It is pierced by two small apertures—the "fenestra ovalis" and the "fenestra rotunda"—which, however, are closed by membrane.

A chain of small bones stretches across the middle ear from the tympanic membrane to the fenestra ovalis. These are the auditory ossicles, and are called from their shape the "malleus" (hammer), "incus" (anvil), and "stapes" (stirrup).

These bones are jointed together, and by their means the vibrations of the tympanic membrane are communicated to the membrane which fills the fenestra ovalis.

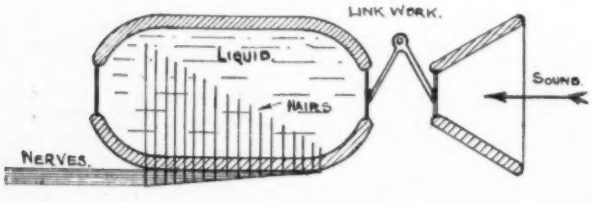


FIG. 3.—SECTION OF MODEL.

The internal ear is composed of two portions, the bony and the membranous labyrinth. The bony labyrinth consists of the vestibule, the semi-circular canals, and the cochlea, which form a series of cavities embedded in the densest portion of the temporal bone. The bony labyrinth contains a fluid called the "perilymph."

The membranous labyrinth has the same general shape as the bony labyrinth within which it lies, and from which, being considerably smaller, it is separated by the perilymph. The membranous labyrinth itself is filled with a fluid called the "endolymph."

The vestibular portion of the membranous labyrinth is divided by a groove into two sacs called the "utriculus" and the "sacculus."

In the utriculus, the sacculus, and each ampulla there is a group of cells with hair-like processes which project into the endolymph. Any movement of this fluid will affect these processes and excite the nerve fibrils, which are connected with them.

In the membranous cochlea, and situated on the basilar membrane, is a very complicated structure called the organ of Corti. This consists of a little tunnel formed of about 3,000 arches, and of some 17,000 to 20,000 hair cells. The fibres of one branch of the auditory nerve terminate in these cells.

When a sound sets the tympanic membrane in vibration, the vibrations are conveyed across the middle ear to the membrane of the fenestra ovalis by the chain of auditory ossicles. The perilymph in the inner ear is thus set in vibration. This vibration affects the membranous labyrinth, and waves are produced in the endolymph which affect particularly the hair cells of the organ of Corti, from which nerve currents are sent up the fibres of the auditory nerve to the brain.

**Audition.**

From the preceding description of the ear we may observe the manner in which audition takes place.

Sounds that impinge on the diaphragm or tympanum of the ear set up vibration according to the character of sound received; these vibrations are communicated by means of link work to another diaphragm (fenestra ovalis) through a vessel containing an incompressible liquid to a third diaphragm (fenestra rotunda), which permits this liquid to be set in motion by the vibrations received by the outer ear. This action agitates the 30,000 odd hairs within the vessel, and as each hair is graded and acts as a tuned reed, particular hairs will resonate to the fundamental and harmonics present in the sound received. The nerves situated at the roots of

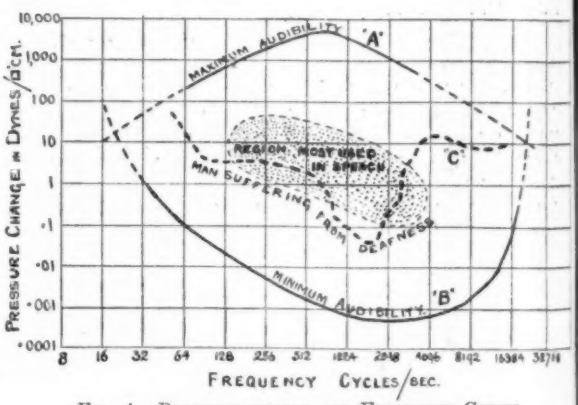


FIG. 4.—PRESSURE-CHANGE AND FREQUENCY CURVE.

these hairs will be stimulated, and will communicate the effect to the brain.

Thus the ear acts as a machine for analysing any sound wave into its various components and transforming the mechnical energy of sonorous vibrations into nervous energy.

A diagram illustrating a mechanical analogue of the above is shown in fig. 3.

Some very interesting results have been obtained by Mr. Wegel giving quantitatively the functional characteristics for the audition of a normal person by showing the relation between sensitivity and frequency. (See the *Physical Review*, June, 1922.) This has been represented diagrammatically as shown in fig. 4.

In the case of a normal person, the detection of sound takes place over a maximum range varying from .001 to 1,000 dynes/cm$^2$.

Curve B shows the minimum audible pressure necessary to produce hearing taken over a range of frequency from 60 to 40,000 cycles per second. Both the intensity and frequency scales are logarithmic.

In the same way curve A represents maximum audibility taken over the same range of frequency. Maximum audibility is the point where a sound produces the sensation of feeling. Sounds louder than this are

painful. All audible sounds must therefore be included within this area.

Included in this figure is a curve showing the region most used in speech. An abnormal ear may be regarded as having an area of sensation which is smaller than the normal area, but included within it.

The area included between curves A and C represents the auditory area of a man with catarrhal deafness in both ears. It will be seen that about 50 or 60 per cent. of normal hearing is retained.

In general, it takes a loss of about 20 per cent. of the sensational area for deafness to become noticeable, much more is disagreeable, while a loss of 50 per cent. requires the use of deaf apparatus; a loss of 75 per cent. requires special apparatus.

### Location.

Besides audition, the location of the source of a sound plays a very important part in hearing. It is beyond the scope of this article to enter into the details of binaural and monaural hearing, but it is important to note certain facts with regard to it.

The location of a pure tone (wave of sinusoidal form)

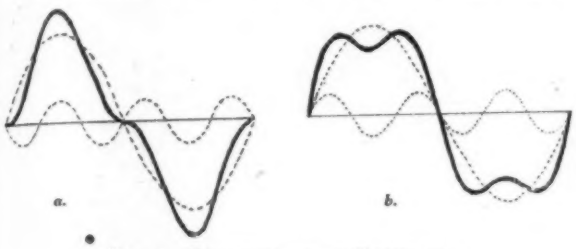


FIG. 5.—WAVEFORMS WITH HARMONICS.

can only be located binaurally, but complex tones can be located monaurally. That is to say, it has been shown that a man deaf in one ear cannot locate a tuning fork vibrating, but can locate a person talking by the direction of the voice.

### Binaural Hearing.

The location of a sound by means of binaural hearing does not depend on a difference of intensity, as might at first be imagined, but upon a difference in phase of the sound as it strikes the two ears.

Air is a medium having a definite velocity of propagation according to well-known laws, which causes sound to be heard in one ear before the other when a sound originates from an oblique direction.

It is interesting to note that the effect of a phase displacement between a fundamental and its harmonics has no discernible effect on the quality or timbre of the sound, as has been previously stated; timbre depends on the number and amplitude of the harmonics present in a fundamental and not upon their relative phases. (See Bureau of Standards Report on "Effect of phase of harmonics upon acoustic quality." Vol. 6, No. 2. June 30th, 1909.)

That means to say that sounds of wave forms as shown in (*a*) and (*b*) of fig. 5, both having a fundamental and third harmonic of the same amplitude, would sound the same.

The effect of phase displacement between the fundamental and its harmonics is constantly taking place in everyday life, *e.g.*, the calculated displacement of a third harmonic at the end of a long telephone line may be as great as three times its own wave length, and yet perfectly good speech results.

However, a phase displacement of a wave taken as a whole between the two ears of a person produces very marked results, and by the result of continual subconscious observation of sounds whose sources of emanation are known, such as the ticking of a clock, the listener readily acquires a general sense of location.

When the source is a complex tone, each harmonic is analysed, and each is treated separately, so that when harmonics are present each result is compared subconsciously and the final result is made all the more certain.

### Monaural Hearing.

The location of a sound by monaural hearing depends upon the relative intensities of a polytone changing with the position of the source of sound owing to the diffraction of sound waves around the head being different for different frequencies.

Thus, a man with both ears normal depends for the location of a sound on a binaural effect and a double monaural effect, while a man with only one normal ear still has a monaural effect to depend upon for his sense of location.

*(To be concluded.)*

# The Training of Apprentices in Evening Schools.

By R. C. WOODS.

IT is a matter of considerable doubt whether the average engineering apprentice gains any real advantage by our present system of evening continuation classes.

To the youth who intends to pass to one of the courses provided by technical college or university it has advantages in that the course of study is a preliminary survey on simple lines of the field to be covered later in detail, and its defects, from an educational standpoint, are the defects of the course to which he goes. To those who intend to remain in the operative grades the instruction is unpalatable in form, with no apparent connection with work or play, and therefore uninteresting.

Anyone of experience will admit that in an average class there is an air of boredom, relieved by occasional interludes of a practical joke nature, which settles on all but the mathematically inclined and speaks for the value of the instruction to the class as a whole. The education obtained is small, the little assimilated is valueless, as they cannot apply it. Where lies the fault, and what is the remedy? The writer by no means claims to have a complete solution, but would present some aspects of the case and offer a suggestion as to possible improvement to those who can by act or influence amend the present wasteful system.

In considering the faults, let us survey the elements concerned.

The boy comes because parent or employer sends him, or, but rarely, because he wishes to gain knowledge: one is willing to be interested, prepared to play the fool; the other comes to work and chafes at delay.

The aim of the teacher is to make the best of the material in the time allowed, with a view to the examination of the local educational union, success in which is the only tangible proof of his teaching abilities. To cover adequately the average examination syllabus and hold a school examination in 40 or 44 hours, it is not practicable to give many demonstrations, while individual experimental work is out of the question. Thus the best method of instruction is lost, and more energy must be expended in keeping order.

Parents send their sons to whatever is provided, and rarely concern themselves as to the value of the instruc-

tion. Few realise the limitations of their children, and usually desire to produce a "brain worker" without consideration of their suitability.

The Evening Schools Committee is apparently bound to the Educational Union, of which it is in effect a voluntary servant, yet it must be the first to move in any attempt to secure a better system. Those employers who are represented on such a body would do well to examine the value of the education if only in the narrow sense of their own advantage, to see if it is worth their support. One can hope for little from the higher education enthusiast who aims at sending pupils to the colleges and will cheerfully sacrifice 95 per cent. to get 5 per cent. through. "Higher education for the masses" is an obsession with some, also a good catch-vote. Grant it freely to those who desire it, but why deny useful knowledge to the many who are unable to profit by the present system? The very people who should see to the training of apprentices, *i.e.*, the Trade Unions, are indifferent or dazzled by "higher education." Large firms can and do run special classes, but the smaller employers can only offer encouragement to evening schools.

To produce a perfect educational system is naturally impossible, yet it should not be difficult to make one more useful. One of the greatest handicaps is the attitude of the pupils. They come because they must, or as a change from home. Education is too cheap to be appreciated.

Teach only those who show a desire to profit, and refuse instruction to all who by behaviour, attendance, or work show that the acquisition of knowledge is not their aim. At first there would be smaller classes, self-disciplined, with more individual attention, and so better results. To education committees, which think in numbers, this will sound like heresy, but it would mean that those who can and will profit are getting the instruction provided. Numbers would soon grow. Withhold anything and it gains in value, and soon more would be willing to impose on themselves the self-restraint to go through a 2-hour class with attention and common courtesy to both fellow pupil and instructor. Teach those elements which have practical application to the work of the pupils, show them how to apply the laws to their business, also the reasoning processes by which particular problems can be tackled. Show the students how to use their brains to save their time, impart to them an appreciation of tools and instruments, their use and care, and inculcate that sense of pride in craftsmanship, which is so sadly lacking in the younger generation of to-day.

Difficulties there would be, but not great ones. Instructors would have to teach on a practical and not an academic basis, and be able to understand and appreciate the needs and difficulties of their pupils. They would have to present the basic laws of their subject by simple explanation and examples of their application, rather than cram into their pupils' heads as many theoretical proofs and data, much of historic value only, as will serve to pass them through a theory examination. Even mathematics can be made more interesting, and the more attention and keen interest the pupils show, the more encouragement there is for the teacher to exert himself.

If some such alteration in the scheme were made, we might get some of our apprentices on the path to becoming genuine artisans, and possibly, nay probably, awaken sufficient interest and understanding in some of the abler of them to push them in active pursuit of the theoretical knowledge which at present seems so uninviting. The matter is worth the careful consideration of all interested in the engineering industry, as craftsmen are a greater asset even than perfect materials.

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**Japanese University Destroyed.**—A fire at the Imperial University at Fukuoka, Japan, recently, destroyed the entire building and the Engineering College, the damage being estimated at £500,000.—*Daily Mail.*

# Correspondence.

*Correspondents should forward their communications* at the **earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

### Pulverised Fuel for Power House Plant.

I have read with great interest the discussion in our technical Press which has followed the reading of Mr. Brownlie's paper.

It is surely not in dispute that pulverised fuel as a means of firing power house boilers has been rendered a success in America and elsewhere and that all grades of coal can be applied with many advantages in this manner.

It also appears to me to be not so much a question of comparison between the efficiency of firing with mechanical stokers and that of pulverised fuel firing, for this figure at normal full-load rating of boilers is in either case approximately equal.

What is of outstanding advantage in pulverised fuel firing is the collective result of boilers standing by with fire chambers closed and no banked fires—a real economy in itself on boiler plant by at least half the amount required for to use small coal of equivalent heat value to large lump coal—the flexibility of a pulverised-fuel-fired boiler to take normal load or forced overload to a very high figure.

The last advantage makes it possible to curtail expenditure on boiler plant by at least half the amount required for stoker-fired boilers, with consequent reduction in capital charges for current generated.

These collective advantages must carry weight when the capital and operating costs of a power plant are under consideration, and they appear to have been lost sight of in a discussion which has taken place relative to efficiencies with mechanical stokers and pulverised-coal-fired boilers and to the one "system" of pulverised coal firing mentioned.

Pulverised fuel firing has advanced for all approved applications beyond any one so-called "system," which is entirely a misnomer. There are but few, if any, patents of exceptional value. It is now a broad art in the development of which a very wide choice of plant has become available, and it is only a mater of accepting the proved results of both plant items and of the recognised effective applications of pulverised fuel to see whether this method of using solid fuel outbids any other method for any one particular purpose.

The use of fuel in pulverised form has added another efficient means of applying coal to the best advantage under prescribed and suitable conditions. One such purpose which has won for itself undoubted success is that of its application to large power house boilers in view of the above advantages, the relative small volume of flue gases, and the absence of smoke.

**Leonard Harvey.**

London, *January 10th*, 1924.

### The Empire Exhibition.—Welcoming Electrical Visitors.

As one who has resided at different periods in various parts of the Empire, it has often been brought home to me that there is a great opportunity for the development of *esprit de corps* amongst the electrical fraternity of its various sections. Perhaps only those who come to England as comparative strangers know how isolated visitors can feel in our great metropolis. They arrive here with warm and kindly feelings for the home country, and perhaps many of them have never visited us before though they may have called England "home" since their birth.

I do not know whether any special arrangements are being made by the electrical community of Great Britain to welcome and look after electrical engineer visitors during the forthcoming Empire Exhibition, but, if not, then I earnestly suggest that prompt measures be taken to this end.

It is not my intention to develop the possibilities in this letter, but quite apart from any fraternal feelings for our electrical colleagues overseas, which should be the true spirit of such welcome, there can be no difference of opinion, I think, of the value of such action from a purely business standpoint.

Probably during no previous period have we had equal opportunities of holding out a friendly hand to these visitors and establishing business relations with them which must ultimately develop for our mutual benefit, and I trust a *united* effort will be made by the various electrical institutions and associations to do something really worthy of our great profession and unique Empire.

**Ernest T. Williams.**

London, *January 7th*, 1924.

[This matter is referred to in our leaderettes.—EDS. ELEC. REV.]

### Electricity in Mining.

Your article under the above heading has brought forth the usual criticism from those whom the cap fits, and who are evidently prepared to wear it.

The A.M.E.E., no doubt, has been the means of providing efficient qualified men for the senior electrical posts at a number of collieries, which simply means progress advocated by the ELECTRICAL REVIEW for years.

I have in mind quite a number of coal mines where the enginewright, who is generally a purely steam man, holds sway over both the mechanical and electrical departments of the mine, and the electrician, who is certified by the manager as being a competent man for his job, is subordinate to the enginewright, from whom he is compelled to take orders. Little wonder that accidents, fatal and non-fatal, occur.

A fallacy appears to exist amongst the coal mining fraternity that it is almost necessary to be born amongst the electrical gear in a coal mine before one can have the slightest claim to be qualified to take charge of mining electrical equipment, surface and underground.

Considering that there are a number of reputable mining electrical equipment makers whose gear is of sound construction, absolutely reliable, fool and flame proof, I fail to see that there is any need for the definition "colliery electrician."

Old time colliery electricians were more or less handy men, and the rapid progress made by electricity in mines has resulted in these men, due to seniority, being placed in charge of large modern plant. Owing to the conservatism that exists, the men under them are generally all colliery-trained men, with a resultant limited experience, relying on the reliability of modern mining gear for the absence of faults, breakdowns, &c.

I recall an instance when a colliery was introducing e.h.p. plant, the pressure being stepped up on the surface for transmission underground for haulage. The firm in question decided to employ a man with e.h.p. experience, and appointed a man for the job, but, strange to say, he did not reign long when it was found that his qualifications really jeopardised the job of the man in charge.

Such a state of affairs does not tend to reduce the number of accidents; in fact, it is surprising that more are not placed on record.

One is tempted to suggest that the decline in the number of accidents recorded is due to the efficiency of mining electrical gear, and not to the fictitious special qualifications of a colliery electrician.

**W. D. Wylde.**

Jarrow-on-Tyne, *January 9th*, 1924.

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### The Quantum Theory.

The insertion of "no" in line four of the seventh paragraph in my letter dated the 5th instant alters the meaning of what I wrote, so I shall be grateful if you will allow this correction to appear.

**Facts Before Fancies.**

*January 12th*, 1924.

[We regret the error, for the occurrence of which we can only blame the printer.—EDS. ELEC. REV.]

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Mr. Western has been so very kind as to explain to us in language as simple as possible the principles of quanta. Some of us, no doubt, have not understood at all, and others have not fully understood, but this does not prove any defect either in his excellent explanation or in the theory. "Facts Before Fancies," although he has evidently set himself the task of reading the matter up, does not seem to have mastered the fundamental principles of physics. I say "seem" because I am only able to judge by his letters, which are an unnecessary attack on the original article.

Regarding the utility of the theory, I might ask: "Why worry?" I discovered some poetry in the ELECTRICAL REVIEW not long ago, and a humorous article this week, so what is the objection to an interesting discourse on a scientific theory, even if "Facts Before Fancies" can prove that it has no practical application?

Even if he is a sturdy devotee of practice, as his ramblings in theory suggest, can't he find enough for his amusement in the REVIEW without quibbling about things that do not concern him?

His complaints are like those of a malingerer who does not know what is the matter with himself.

**Astonished.**

*January 12th*, 1924.

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### Fine Ash from Pulverised Fuel.

Some people seem to be unduly exercising themselves about the fineness of the ash which results from burning powdered fuel. They think that, because a good deal of it is allowed to go up the chimneys of certain plants, therefore it is a nuisance, but the mere fact that it can be so dissipated into the atmosphere shows that it is so fine that the authorities have no complaints to make.

In the United States the police and health authorities are just as particular as in this country; in fact, I have seen conditions in some large cities in this country which would not be tolerated in Boston, New York, Chicago, Philadelphia, or Milwaukee. There are, for instance, places in this country where so many gritty ash particles are cast out of furnaces fired by mechanical stokers that when one walks near the power stations it is like walking on powdered ice.

Although the fine ash from powdered fuel is no nuisance it is quite likely that in the near future efforts will be made to catch as much of it as possible because of its value as a by-product. A demand is springing up for it for certain chemical and metallurgical purposes because:—

(*a*) The extreme fineness is desirable, no further grinding being necessary.

(*b*) The high temperature through which it has passed thoroughly shrinks the material.

(*c*) It is practically free from carbon, and is quite neutral chemically.

Ashes from mechanical stokers cannot be used for the special purposes above referred to, because they contain a considerable amount of carbon; even 40 per cent. has been registered, and 15 per cent. is common. The clinker does not contain so much, but from 2 to 5 per cent. is commonly met with, depending on the fusibility of the ash. Even if clinker contained no carbon it could not be used for the above purposes because of the expense of grinding it to a fine powder.

The demand for the fine ash of pulverised fuel promises to increase as fast as the material is produced, and it is quite likely that a steady income can be reckoned upon by those who are enterprising enough to adopt pulverising plant and take the trouble to collect the fine ash and market it. As much as 10s. per ton has been offered for it. One way to prevent ash from slagging is to have the combustion chamber large and admit sufficient air to keep down the temperature at the bottom. Of course, if too much excess air is admitted, then the percentage of $CO_2$ in the flue gases comes down, with lowered efficiency, because of the heat that is being taken away by the air. This can be overcome by having a nest of water pipes at the bottom of the chamber connected to the boiler in such a way as to ensure rapid circulation of water through them and absorb the radiant heat of the furnace. By means of the water-tube screen the ash is deposited in the form of fine dust easy to discharge.

**E. Kilburn Scott.**

London, *January 9th*, 1924.

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### E.h.p. Transmission Lines.

I have read with interest Mr. Borlase Matthews's articles on e.h.p. transmission; in view of the importance of overhead transmission at high voltages, it is surprising that this method has not been adopted far more in this country.

The supply companies have experienced a good deal of trouble in the past with overhead lines, and I suppose this makes them over-cautious. I should say that the chief trouble was due to faulty construction of the lines, bad earthing, and faulty insulators.

Some years ago I experienced a lot of trouble and anxiety with glass insulators of the pin type. During wet weather the insulators would get warm, due to leakage, and this caused them to crack and "earth" the wires through the insulator pins. These have since been replaced by porcelain insulators of a similar pattern, and they do not give the slightest trouble on a 6,700-volt, 3-phase line.

When constructing an overhead transmission line, it is absolutely essential that all the insulator pins be efficiently "earthed." If you have a faulty insulator, and the pin is not "earthed," the current will flow along the pole arm and burn off the arm or the top of the pole, and this, of course, will interrupt the supply for a considerable time.

On a 6,500-volt, 3-phase line, with the neutral insulated, I have seen a line wire burnt in two, not because the fault has been on two phases, but owing to the insulator breaking and the capacity current of the line discharging intermittently to "earth" until the wire was burnt in two by arcing.

The intermittent fault on a 3-phase line, with the neutral insulated, is dreaded by all supply engineers, owing to the fact that the faulty line wire is reduced to "earth" potential, and the phase voltage of the transformer or generator is increased from 3,750 to 6,500 volts to earth, assuming that the line voltage is 6,500.

While the fault is intermittent, the capacity current is flowing from the other phases, through the fault, and this increases the voltage on the end turns of the machine (or transformer) and line to probably double the line pressure.

If the line is "dead" to earth, it is still possible to supply current, but the phase voltage of the transformer will still be at the delta voltage instead of 3,750 volts. The number of transformer breakdowns is considerably increased owing to the stresses set up by faults on transmission lines; and if the overhead line is in series with an underground cable, faults will develop at the joint-boxes. All overhead lines should be properly spaced, the insulators should be strong and of good quality, and every insulator pin or shackle should be efficiently earthed.

**Pelican.**

Hull, *January 7th*, 1924.

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### Squirrel-cage Motors of Over 5 h.p.

Your leader "On Making Progress" (December 28th) prompts me to draw attention to a matter which seriously impedes the introduction of electrical power in England.

Twenty or thirty years ago, when power stations were small, some engineer invented a clause: "Squirrel-cage motors may be used up to 5 h.p., above which wound-rotor motors must be installed."

Although power stations are reaching 20,000-kW units, and cables are as big as gas pipes, this 20-year-old restriction is

still made, and, what is more, is enforced by many corporation engineers with almost super-power stations.

The squirrel-cage motor is the simplest and cheapest form—why not use it? "Because starting it will cause a flicker in my lights," says Mr. A. (corporation engineer), and he prohibits a 25-h.p. squirrel-cage motor in the same building in which he is installing a 200-h.p. wound-rotor motor, which takes full-load current on the first step of the controller.

"Because its power factor is low at starting," says Mr. B. (corporation engineer), and he prohibits a 30-h.p. squirrel cage motor on a feeder that feeds a 1,000-ampere electric furnace with a power factor of perhaps 0.5.

"Because it is in the rules," says Mr. C. (assistant corporation engineer), "and I should have to consult the chief, who is very busy."

There *are* some enlightened corporations (I know of 150-h.p. squirrel-cage motors on corporation mains), but the rule is there, and every installation has to be fought for as if one were trying to steal current and not to use and pay for it.

Contrast this with the attitude of the private power companies on the North-East Coast, which welcome a real load, and allow squirrel-cage motors of 300 h.p. to be installed—because they appreciate that a cheap and reliable type of motor will bring more customers.

I am an interested party, because my job is to sell motors, but my firm is not the only motor manufacturer, and it is the whole electrical industry that is impeded by this 1890 attitude of so many electricity supply authorities.

May I quote to you from your leader "On Making Progress":—

"We are afraid that there always will be some good people in the electrical world who will lag behind. No doubt they serve a useful purpose of some sort—if it is only to form a tail to the procession of those who are anxious to be ahead and well ahead—but, unfortunately, they may act as a drag, and needlessly slow down the pace of the more energetic."

"It is the stick-in-the-mud type permanently within our gates that we cannot abide."

"Electricity is likely to go ahead in all directions far more rapidly if the generally-expressed desire for development is accompanied or followed by consistent action."

In conclusion, municipal engineers, by insisting on a needlessly more expensive motor equipment, are retarding the development of the industry. In many ways their attitude is reminiscent of the days when railways were opposed or only suffered if run half-a-mile away from the town, and on condition that no railway station was built. I may liken them to the man with the red flag in front of the electricity motor car. If the petrol motor-car industry had not abolished the red flag idea it would not have reached its present state of development to-day. The red flag and the 5-h.p. s.c. rule have both served their purpose and to-day both equally belong to the past.

**Motor Sales Engineer.**

*January 8th*, 1924.

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### Prospects in New Zealand.

Could you, or any reader give me any information regarding work and prospects (in the electrical trades) in New Zealand in the near future? Work for wiremen, general electricians, and armature winders; rate of pay, hours weekly, and any other information likely to be of interest.

**Genuine.**

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### A Libel on the Megger.

I am thinking of serving you with a writ for libel on behalf of a testing appliance in which I have a fatherly interest. The libel is contained in an article by Mr. Borlase Matthews, which appeared in your issue of December 21st last. In the course of a brief account of the methods employed by Mr. C. E. Bennett, of Barcelona, for testing earthenware insulators, Mr. Borlase Matthews informs us (p. 931) that Mr. Bennett never makes Megger tests "in the early morning or late evening as the Megger is found to be very sensitive to humidity changes." It appears that Mr. Bennett acquired this odd inversion of ideas from a "a scholarly paper by Messrs. Farr & Philpott, who have investigated the matter *rather* carefully." Scholarly is Mr. Bennett's word, the italics are mine.

Now on turning to the paper in question, which was published in the *Journal* of the American Institution of Electrical Engineers, October, 1922, No. 10, I find that Messrs. Farr and Philpott made this investigation in New Zealand, and reading their account of insulation testing I should say that Mr. Bennett's phrase, "rather carefully," precisely hits the mark. They record in a diagram an interesting and manifestly accurate comparison between the humidity of the air and the insulation resistance of an earthenware insulator. A copy of their diagram accompanies this letter, and it will be noticed how the insulation resistance of the insulator is affected by the humidity. The resistance naturally increases as the day advances, because the film of moisture which condenses on the surface of the insulator during the coolness of the night evaporates in the warmer air of day time.

Such is the plain story told by the Megger. The instrument is not retrospective. It does not speak of itself. The purpose of the Megger testing set, if I may say so, is to tell people things about the insulators they are testing; things they would not otherwise know. But that is not how these two investigating engineers interpret the diagram. For them it is almost inconceivable that anything can be happening to the insulator itself. That cannot be. Obviously something happens to the Megger, for it behaves in the same way even when "dry as received," so Messrs. Farr and Philpott say.

These rather careful engineers (I thank Mr. Bennett for the qualifying word) having set going the fable that humidity affects the Megger, in course of time it arrives in England, *via* Amercia and Barcelona, having grown more definite *en route*, and now it bids fair to end in the issue of a writ and goodness knows what to follow.

The topsy-turvy notion that a testing instrument which tells you something unexpected must be wrong, is widespread in the engineering world. Every instrument maker is acquainted with the engineer who complains that a voltmeter

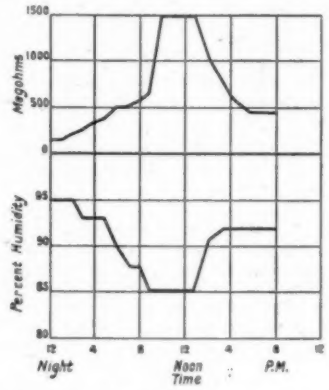


FIG. 1.—INSULATION AND HUMIDITY CURVES. 66,000-V PIN INSULATOR.

is wrong because it reads 91 volts whereas the lamps are plainly marked 100. It almost needs a surgical operation to get him to realise that the reason why the voltmeter does not indicate 100 is that the voltage is not 100, and that the voltmeter is there to tell him so.

Topsy-turvydom as regards insulation is perennial. Knowing how firmly rooted is the idea that an insulator has a fixed quantum of insulation resistance and that if a testing instrument does not indicate that quantum then the instrument must be wrong, I spent some of the best years of my life investigating the universal influence of moisture on insulation, and the results were embodied in a paper (*Journal* I.E.E., Vol. 52 (1914), p. 51) which presented the facts as they are, and made things clear, so I vainly thought. But it was not so. To-day English engineers (Mr. Borlase Matthews is one of them) seldom refer to the *Journal* of their own Institution. They look mainly to America (and Barcelona) for information, and so enormous is the insulation resistance of the human mind that a dozen years after the publication of that paper we are gravely informed that "the Megger is very sensitive to humidity"! I have wasted my time. I should have been better employed in keeping pigs, as my ancestors did.

And now it only remains for the Editor to say when he would like to receive that writ?

**Sydney Evershed.**

London, *January 4th*, 1924.

P.S.—Just a word of warning to your readers about a common domestic measurement. On Monday my cook weighed a new, moisture-laden, 2-lb. loaf and found it weighed 2 lb. 1 oz. On Wednesday she weighed the loaf again and it needed only 1 lb. 18 oz. to balance it; the same loaf untouched. We learn from this that a weighing machine is very sensitive to the humidity of the atmosphere, and loaves should, therefore, only be weighed on Mondays, never on Wednesdays. That is the logic of it—in New Zealand—and America—and Barcelona.

[Our regret for the "libel" is tempered by our enjoyment of Mr. Evershed's letter. We should prefer to receive the writ on February 30th.—EDS. ELEC. REV.]

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### Single-phase Induction Motors and the Starting Problem.

I have read with much interest Mr. Davies's article on the starting problem of single-phase motors, and should like to comment on at least two of the many debatable points which he raises. In dealing with the starting troubles of single-phase motors the writer refers to the case of the motor which starts from rest perfectly satisfactorily, but fails to accelerate beyond some sub-synchronous speed. These troubles are in general due to the presence of a pronounced harmonic in the field form. The effect of this, it is true, can be overcome, to some extent, by increasing the rotor resistance, as the writer suggests. It should be borne in mind, however, that one of the fundamental differences between the three-phase and the single-phase motor is that in the former the rotor resistance

merely determines the speed at which the maximum torque occurs, whereas in the latter case an increase of rotor resistance will actually reduce the value of maximum torque obtainable. For this reason it is highly undesirable to increase the rotor resistance more than is absolutely necessary, and it would be preferable to improve the starting performance, either by choosing a slot combination which will eliminate the pronounced harmonic, or by so designing the rotor that the harmonic, though present, can produce no torque.

The writer's statement that the rotor resistance should be embodied in the bars in preference to the rings is somewhat questionable. From considerations of heating it would certainly appear preferable that the heat should be generated in the rings, *i.e.*, on the ends of the rotor, rather than in the body of the rotor, from whence in finding its way to the outside it would cause a general rise in temperature in the machine. In any case the current carried by the joints to the rings would remain the same.

There is undoubtedly a very large field of application for the single-phase induction motor, especially in small sizes; nevertheless, the amount of literature available dealing with the design of these motors and with the starting problem in particular, is comparatively small. I think, therefore, that Mr. Davies is to be congratulated on his endeavour to throw light on a somewhat neglected subject.

**H. Boswell Lee, A.M.I.E.E.**

Sale, *January 7th*, 1924.

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With the development of utility machines during the past few years, there has been an increasing demand for fractional-h.p. single-phase motors. This demand will probably continue to expand, but the single-phase induction motor is hardly likely to prove a rival to the three-phase motor even were its starting performance satisfactory. The efficiency and power factor are much lower and the cost higher in the case of the single-phase motor as compared with the three-phase motor. The single-phase motor has its own special field of application, that is in the driving of utility machines and where a three-phase supply is not available.

As the author points out, the starting of single-phase motors is probably one of the most important points in the design, and, unfortunately, a high rotor resistance which has a beneficial effect on the starting performance has a detrimental effect on the overload capacity. It is necessary, then, to strike a balance between the two limits when designing such machines.

In connection with the windings it should be noted that sub-dividing or distributing the winding of a motor in a greater number of slots does not increase the self-induction of that winding, as the author states, but actually decreases it, thereby improving the power factor. An increase of self-induction lowers the power factor. This is, of course, interpreting the term "self-induction" in the usual way as the back e.m.f. due to the flux linking that winding only.

It is a simple matter to predetermine the starting performance of a single-phase induction motor as regards the locked torque, but the real difficulty is to produce a motor which, having started the load, will carry it up to full speed. With the split-phase method of starting, the torque depends upon the phase difference of the currents in two windings, and in many cases this phase difference becomes less with increase in speed. Then, again, the split-phase-started motor is, during the starting period, a very badly unbalanced two-phase motor, with its field form containing harmonics of large amplitude. It may "hang" at a speed corresponding to the synchronous speed of any of these harmonics, such as 1/5th, 1/9th, 1/13th (not 1/7th) unless special precautions are taken to deal with the trouble.

**D. B. Hoseason.**

Manchester, *January 7th*, 1924.

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# Business Notes.

**Bankruptcy Proceedings.**—HENRY PICKFORD GALT, 56, Norbury Road, Thornton Heath, Surrey, electrical engineer.—The first meeting of the creditors of the above was held on January 4th, at 29, Russell Square, W.C.1. The statement of affairs showed liabilities of £334, against assets of £18, or a deficiency of £316. Debtor attributed his failure to judgment for costs obtained in an action against him for trespass. It appeared that in November, 1918, he commenced business as an electrical engineer at his present address with £100 capital. He had previously acquired the freehold of the premises by taking over a mortgage for £250 and paying £30. The property conveyed included a right-of-way at the rear of adjoining premises, the use of which necessitated the removal of a fence. On the advice of his solicitors he removed the fence, with the result that an action for trespass, damages and costs was commenced against him by the owner of the adjoining property, who obtained an injunction with costs, amounting to £242, and subsequently caused an execution to be levied on his effects, whereupon he filed his petition. The case being a summary one, was left with the Official Receiver as trustee of the estate.

WM. SINCLAIR TAYLOR, electric lamp manufacturer, Earlswood, Winterbourne Gunner, near Salisbury, and lately residing at 20, Redcliffe Square, Kensington.—The first meeting of creditors herein was held on January 10th at the London Bankruptcy Court. The receiving order was made on December 27th upon the petition of Lloyds Bank, Ltd.

Mr. W. D. Williams (Official Receiver) reported that it appeared from the debtor's statements that he commenced business on his own account in 1912 at Jewry Street, London, as a manufacturer of and dealer in electric lamps. Shortly afterwards the business was converted into a limited company, of which he was appointed managing director and whose business came to an end on the outbreak of war. During the period of hostilities the debtor was engaged on work of national importance. In 1920 his wife commenced business in Rangoon Street, London, as an electric lamp importer and registered it as the "B.T.T. Lamp & Accessories Co." She was joined in the undertaking by a Mrs. Thornton, who took a one-half interest and the debtor managed it on their behalf. In 1922 he ceased to act as their manager and bought the business of the Aladdin Renew Lamp Co., then being carried on at Harrow Road, Willesden Junction, the purchase price being £3,500, paid with his own money. He refitted the premises with new machinery and stock and subsequently sold the business to "Willesden Electric, Ltd." for £5,000 in shares and £10,000 in debentures. The valuation was taken at £13,500, the balance being represented by goodwill. The debtor was appointed managing director of that company, and owing to a shortage of capital Lloyd's Bank advanced £6,000, in instalments of £2,000 each, on a debenture for which the debtor gave his personal guarantee. The shortage of capital, however, continued, and at Easter last the bank gave notice to recall their loan. The debtor paid £1,900 on account, but shortly afterwards he was sued for the balance of his guarantee. The bank put in Mr. Clemans, C.A., as receiver and recovered judgment against the debtor for £4,500, which debt was the subject of the present proceedings. The statement of affairs had yet to be lodged, but the debtor roughly estimated his liabilities at £6,000 and the assets included his £10,000 debentures (charged for £300) and £5,000 shares in "Willesden Electric, Ltd." (certificate not yet issued), also the freehold house "Earlswood," Winterbourne Gunner. The cost of that house was £1,800 and £5,000 had been expended on rebuilding, &c.; it was subject to a mortgage of £3,200 and a second charge of £350. The debtor attributed his failure and insolvency to his liability under the guarantee given on behalf of "Willesden Electric, Ltd.," and to the non-receipt of salary from that company.

The case remained in the hands of the Official Receiver, to be wound up in bankruptcy.

ALBERT O'HARA BRADSHAW, 6, Old Square, Birmingham, Warwickshire, general merchant.—The adjourned public examination of this debtor was held recently at Birmingham. The statement of affairs showed a deficiency of £11,216. Debtor attributed his failure to overbuying on a falling market and commencing business with insufficient capital. It appeared that he started business with £50 capital, and when the slump in wireless goods took place in April last he was overstocked, was under contract to take further goods, and had to sell at under cost price. Debtor alleged that he had handed over all documents relating to his business. He had two banking accounts, and was closely questioned with reference to cheques drawn on these accounts. He denied that since the receiving order he had told anyone that he had about £10,000 worth of goods hidden away. The case was further adjourned.

JOHN MICHAEL, 6, Sneyd Terrace, Silverdale, and 20, George Street, Newcastle-under-Lyme, Staffordshire, electrical engineer.—The receiving order in this matter was made on July 12th on debtor's own petition. The statement of affairs showed liabilities of £430 and assets of £117, leaving a deficiency of £313. The first meeting of the creditors was held on August 23rd at the Official Receiver's office, 9 Brook Street, Stoke-on-Trent, when the case, being a summary one, was left in the hands of the Official Receiver as trustee. The following are creditors:—

| | £ | | £ |
|---|---|---|---|
| Bill & Berry ... ... ... ... | 36 | Midland Wireless Co. ... ... | 14 |
| Clarke & Co., H. ... ... ... | 16 | Teeton, W. H. ... ... ... | 35 |
| Calmont, King & Co. ... ... | 21 | Woodward & Smith ... ... | 12 |
| Downes & Davies ... ... ... | 130 | Shenton & Co. ... ... ... | 10 |
| Harris & Co., F. W. ... ... | 17 | Bankers ... ... ... ... | 50 |

R. SPRINGER, electrical engineer and contractor. The application for discharge was fixed for hearing on January 14th, at the Court House, Manchester.

W. P. YOUNG (W. P. Young & Co. and the Leicester Tanning Machinery Co.), 40-42, Saxony Gate, Leicester. Last day for proofs for dividend January 22nd. Trustee, Mr. T. F. Birch, Court Chambers, Friar Lane, Leicester.

W. T. GARNETT (W. T. Garnett's Cable Co.), electric cable and wire manufacturer, Barkerend Mills, Bradford.—Supplemental dividend of 3 2/5d. in the £, payable January 18th, at the Official Receiver's Office, 12, Duke Street, Bradford.

FRANCIS SMITH, trading as Frank Smith, 6, Imperial Buildings, Dale End, Birmingham, Warwickshire, wholesale electrical accessories factor.—The first meeting of the creditors of the above was held on January 9th at the Official Receiver's Office, Ruskin Chambers, Corporation Street, Birmingham. The statement of affairs showed liabilities of £843, with a deficiency of £314. Debtor attributed his failure to commencing business with insufficient capital and bad trade. It appeared that he was employed as an assistant by a wholesale electrical factor, and for a short period dealt in electrical goods on his own account. In March, 1923, he gave up his employment and commenced business as a wholesale factor of electrical accessories, with a capital of £50, but he stated that this amount was insufficient to conduct the concern successfully. The debtor's drawings amounted to £150, against a net trading loss of £23. It was decided to appoint Mr. C. T. Appleby as trustee, with a committee of inspection.

RD. JAMES WILFRED O'CONNOR (lately trading as The Lacland Electrical Manufacturing Agency), 68, Great Queen Street, London, E.C.—This debtor attended before Mr. Registrar Francke on January 11th, at the London Bankruptcy Court, for public examination upon accounts showing gross liabilities of £641 (unsecured £581), and assets nil. In reply to Mr. F. Vyvyan, Official Receiver, the debtor stated that he served during the war in H.M. Army and upon being demobilised in November, 1919, received a gratuity of about £175. He was employed as a traveller until September, 1922, when he commenced, and until February, 1923, unsuccessfully carried on business as a dealer in wireless sets under the above style. He was then joined by a partner, who put £300 into the business, but after two or three weeks' trading the partnership was dissolved and witness had since been without remunerative occupation. He attributed his insolvency to lack of capital. The examination was concluded.

ENGINEERING SUPPLIES Co., mechanical and electrical engineers, 24, Grey Street, Newcastle-on-Tyne. Receiving order made January 8th on creditor's petition.

T. G. H. WILEY (Wiley & Co.), electrical engineer, Bradford Road, Stanningley, Yorks.—First meeting January 18th, at the Official Receiver's office, 12, Duke Street, Bradford; public examination January 21st, at the County Court, Bradford.

C. A. CARPENTER, electrical engineer, 4-5, Masons Avenue, Basinghall Street, E.C.1.—Discharge suspended for two years and six months. Date of discharge June 12th, 1926.

L. HOLMAN, electrician, 11, Camden Road, Bridgwater, Somerset.—First and final dividend of 7d. in the £, payable at the Official Receiver's office, 26, Baldwin Street, Bristol.

G. A. MORLEY, electrician and wireless engineer, 201, Powis Street, Woolwich.—Receiving order made January 5th, on debtor's own petition. First meeting January 22nd, at 29, Russell Square, W.C.; public examination February 19th, at the Court House, Greenwich.

P. BUTLER (Eastern Electrical Engineering Co.), electrical engineer, late of 127, King Street, Yarmouth, Norfolk.—Receiving order made January 8th on debtor's own petition.

**Company Liquidations.**—WHITE, ANDREWS & Co., LTD., Marlborough Works, Marlborough Road, London, N.19, manufacturing electrical engineers.—Pursuant to Section 188 of the Companies (Consolidation) Act, 1908, a meeting of the creditors in this matter was held on January 7th, at the offices of Messrs. Hunter, Jones, Halford & Co., I.A., 15, Water Lane, E.C.4, when the chair was taken by Mr. Jones. No statement of affairs was submitted but Mr. Jones stated that the liabilities were approximately £5,000. Mr. Jones said that so far as the assets were concerned the only information he had been able to obtain was from a balance sheet dated July 31st last. The stock at that time was shown at £1,287, small tools £100, plant £396, fixtures £353, and book debts £289. The trade creditors amounted to about £600, the balance being made up by loan creditors, who held no security whatever. There was an overdraft of about £200 at the bank and the latter held no security. It was said that the company was formed in December, 1921, with a nominal capital of £10,000, of which £5,841 had been issued. The accounts for the year ended July, 1923, showed a loss of £1,042, while during the year ended July 31st, 1922, there was a loss of £2,706. No accounts had been prepared since July, 1923. After some discussion it was decided to appoint Mr. E. H. Hawkins, of Messrs. Poppleton, Appleby and Hawkins, accountants and auditors, of 4, Charterhouse Square, E.C., as joint liquidator with Mr. Hunter. A committee was also appointed. The following are creditors:—

| | £ | | £ |
|---|---|---|---|
| Ira Miller & Co., Ltd. ... ... | 69 | Ingram, Perkins & Co., Ltd. ... | 25 |
| Everett Edgcumbe & Co., Ltd. | 13 | Hy. Righton & Co., Ltd. ... ... | 66 |
| Hunter, Jones, Halford & Co. ... | 26 | G. Wade & Son, Ltd. ... ... | 22 |
| Izons & Co., Ltd. ... ... ... | 69 | Shaws Glazed Brick Co. ... ... | 93 |
| Record Electrical Co., Ltd. ... | 13 | Smith & Sons ... ... ... | 45 |
| City & West End Drawing Office | 11 | E. Bryan Hasclden ... ... | 14 |
| Kent, Wm. ... ... ... ... | 16 | | |

PEERLESS FLASH LAMP Co., LTD.—Winding up voluntarily. Liquidator, Mr. T. Wood, Crown House, Aldwych, W.C.2. A meeting of creditors is called for January 18th, at Crown House; particulars of claims to the Liquidator by February 13th.

ELECTRICAL SERVICES, LTD.—Particulars of claims to the Liquidator, Mr. P. Hodgkinson, 48, Sundridge Road, Bradford, by February 14th.

ELECTRIC AUTO SUPPLIES, LTD.—Winding up voluntarily. Liquidator, Mr. C. F. Bird, 37, Great James Street, W.C.1. Meeting of creditors at the liquidator's offices, January 22nd. Particulars of claims by February 15th.

STOCKPORT LAMP Co., LTD.—Winding up voluntarily. Liquidator, Mr. W. P. Masterson, Bank of England Chambers, 1a Lane, Manchester. Meeting of creditors at Bank of England Chambers January 21st.

COUNTY OF DORSET ELECTRICITY SUPPLY Co., LTD.—Winding up voluntarily. Liquidator, Mr. Hawkins, of Messrs. Touche and Co., Basildon House, Moorgate, E.C.2.

ALADDIN RENEW ELECTRIC LAMP CORPORATION, LTD.—A meeting of members is called for February 11th, at 15, Grosvenor Mansions, 82, Victoria Street, S.W., to hear an account of the winding-up from the liquidator, Mr. H. Foster.

BRITISH SCIENTIFIC APPARATUS MANUFACTURERS, LTD.—A meeting of members is called for February 14th, at the offices of Messrs. Cash, Stone & Co., 90, Cannon Street, E.C., to hear an account of the winding-up from the liquidator, Mr. J. H. Mitchell.

**Private Arrangements.**—F. J. YATES (trading as F. J. Yates and Co., electrical contractor, Leicester).—A statement of the trustees' accounts and of the proceedings under this deed (see ELECTRICAL REVIEW, February 23rd, 1923, p. 291) to December, 1923, has been issued. The receipts were £2,691, and the payments included £645 as a first dividend of 2s. 9d. in the £ on claims of £4,690, £300 for trustees' remuneration on account, and a balance of £54 in hand. The total payments into Lloyd's Bank, Ltd., to December 31st, 1923, were £2,531, and the total payments out of the bank were £2,477. The amounts of the assets and liabilities at the time the deed was executed as estimated by the debtor were: Assets, after deducting £4,595, the value of securities held by creditors and required to cover debts due to them, £5,553; liabilities, after deducting £4,595, the amount covered by securities, £5,516. The nature and value of the assets unrealised are: Book debts, estimated to realise £13; work executed estimated to realise, £203. The delay in the winding up is due to the difficulty experienced in collecting the above accounts and to the fact that a large amount payable under an architect's certificate is not yet forthcoming. The estate will probably be wound up within three months. The assets as appearing in the statement of affairs were considerably overvalued by the debtor. The trustees continued trading, and kept the business intact, hoping thereby to sell it as a going concern, but they had to dispose of the property by public auction. Although the amount obtained did not produce sufficient to discharge the amount due to the mortgagees and auctioneers' costs, the price obtained relieved the estate from a large claim by the bank, which has been to the advantage of the estate.

**Dissolutions of Partnership.**—TOMSETT & GRENYER, heating and electrical engineers, 24, North Street, Worthing.—Mr. C. Tomsett and Mr. W. A. Grenyer have dissolved partnership. Mr. Tomsett will attend to debts and continue the business under the same style.

ROBINSON & BLACKWELL, electrical engineers, 58, Halford Street, Leicester.—Mr. W. G. M. Robinson and Mr. J. S. Blackwell have dissolved partnership. Debts will be attended to by Mr. Blackwell, who will continue the business at 19, St. Martins, Leicester.

UNWIN & READ, electrical engineers and agents, 14, Cheapside, Hanley.—Mr. D. J. Unwin and Mr. H. S. Read have dissolved partnership, Mr. Unwin having accepted an appointment in Ceylon. Debts will be attended to by Mr. Read, who will continue the business under the same style and at the same address.

J. MARSDEN & SONS, plumbers, sanitary and electrical engineers, 1, Upper Head Row, Huddersfield.—Mr. J. W. Marsden and Mr. R. Marsden have dissolved partnership. Mr. J. W. Marsden will continue the business.

**Trade Announcements.**—THE MIDLAND ELECTRIC MANUFACTURING Co., LTD., has appointed Mr. G. T. HICKLING to be its sales representative in South Wales and the South-Western territories.

Mr. J. T. BEAUMONT, electrical engineer, of 15, Victoria Street, Huddersfield, announces that he is declining business.

Messrs. DAFFERN & EDWARDS, electrical engineers, &c., High Town, Hereford, have taken into partnership Mr. Henry J. Darlow, of Maidenhead.

Messrs. INGHAM BROS., of 56, Manchester Road, Bradford, have been appointed sole agents for Yorkshire and Lancashire for the sale of English alabaster bowls made by Mr. R. G. Lomas, of Derby.

The designation of THE CRAVEN AND DISTRICT PRIVATE TELEPHONE AND ELECTRIC Co., LTD., has been changed to THE CRAVEN AND DISTRICT ELECTRICAL CONSTRUCTION Co., LTD., but no alteration has been made in the management.

THE GENERAL CABLE Co., LTD., of Kingston Road, Leatherhead, Surrey, has acquired the business and assets of Messrs. Hulburn & Co., 42, Southwark Street, London, S.E. All correspondence with regard to old business and accounts should still be addressed to Southwark Street, but regarding all new business to Leatherhead.

THE COMPAGNIE GENERALE ELECTRIQUE, of Nancy, France, announces that it has taken over from La Métallurgique Electrique the works of the latter company in Paris, where the Vedovelli fittings have hitherto been manufactured, and

will devote its Nanterre factory also to the production of the apparatus associated for many years with the name of M. E. Vedovelli. La Métallurgique Electrique will continue to manufacture at its Ivry-sur-Seine works transformers, traction supplies, drawn copper and aluminium, and insulating material, in addition to its customary mechanical engineering products.

MESSRS. BRUCE PEEBLES & CO., LTD., of Edinburgh, have appointed Messrs. Sellar Inglish & Co., of 144, St. Vincent Street, Glasgow, as their agents for the West and North of Scotland.

**Catalogues and Lists.**—CHLORIDE ELECTRICAL STORAGE CO., LTD., Clifton Junction, Manchester.—That the Exide battery service, given by the 350 service agents throughout the United Kingdom, is of considerable value to the trade and to battery users is an established fact, but realising the need for proper care and attention to batteries on the part of anyone into whose hands they come for use or repair, a series of technical letters has been commenced which will be issued periodically to all traders and garages. A file to contain them has been sent out with No. 1; the letters give, in simple terms, the fullest information as to the treatment of storage batteries.

THE ANGLO-SWEDISH ELECTRIC WELDING CO., LTD., Wood Wharf, Greenwich, S.E.10. An illustrated leaflet dealing with totally-enclosed arc welding plant, and a pamphlet detailing results obtained with this plant and special electrodes.

MESSRS. CONDOR LAMPS (GREAT BRITAIN), LTD., 60, Wilson Street, Finsbury Square, E.C.2. Price lists of "Condor" lamps of many patterns, including automobile and traction lamps.

MESSRS. WATSON & SONS (ELECTRO-MEDICAL), LTD., Sunic House, Parker Street, Kingsway, W.C.2. Bulletin 57s, describing in detail X-ray apparatus for dental purposes, and Bulletin 58s dealing with waterproof surface intensifying screens.

MESSRS. AUTOMATIC AND ELECTRIC FURNACES, LTD., 173-175, Farringdon Road, E.C.1. "Heat Treatment Bulletin No. 31," dealing with the selection of material and heat treatment for tools.

THE BRUSH ELECTRICAL ENGINEERING CO., LTD., Falcon Works, Loughborough. Leaflet 501/10-6, containing illustrations and report of test of slip-ring and mining-type induction motors.

MESSRS. LACY-HULBERT & CO., LTD., 91, Victoria Street, S.W.1. Pamphlet No. 24, illustrating and describing compressed air tools for engineers and contractors.

MESSRS. FULLER'S UNITED ELECTRIC WORKS, LTD., Woodland Works, Chadwell Heath, E. Leaflet No. 316, bearing illustrations and a brief description of "Sparta" loud speakers and "tone selectors." Priced.

THE IMPERIAL ENGINEERING CO., Electric House, Grape Street, Shaftesbury Avenue, W.C.2. An illustrated and priced leaflet giving particulars of electric fires, kettles, irons, &c. A paper-weight in the form of a miniature iron accompanied the pamphlet.

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2. January price list of electrical supplies, including radio apparatus, domestic appliances, wiring materials, &c.

THE MACINTOSH CABLE CO., LTD., 22 and 23, Jewin Street, E.C.1.—An illustrated booklet dealing, in a way interesting to householders, with the "Macintosh" surface wiring system.

Messrs. C. A. VANDERVELL & CO., LTD., Acton Vale, W.3.—Three folders, dealing with "C.A.V." batteries and battery service.

Messrs. CENTRIFUGAL CLUTCHES, LTD., 32, John William Street, Huddersfield.—An illustrated booklet describing the "Lydall" centrifugal clutch.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—January list of motors and dynamos in stock.

Messrs. SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38-39, Upper Thames Street, E.C.4.—An illustrated catalogue (No. 92) containing prices and illustrations of "Xcel" heating, cooking, and labour-saving electrical appliances.

MESSRS. BRECKNELL, MUNRO AND ROGERS, LTD., Bristol.—A publication containing many illustrations of porcelain insulators, fittings covered with moulded mica insulation, &c. Also a folder dealing with current collectors of the slipper, pantagraph, and other types.

MESSRS. BERRY'S ELECTRIC, LTD., 66, Newman Street, Oxford Street, W.1.—A priced pamphlet dealing with "Sunblaze" "Magicoal" fires.

MARCONI'S WIRELESS TELEGRAPH CO., LTD., Marconi House, Strand, W.C.2.—An illustrated pamphlet, No. 225, fully describing the type YP1 infantry and observation post radio transmitting and receiving set.

MESSRS. P. L. DWYER & CO., 30, Grosvenor Place, S.W.1.—January price list of wires, cables, conduits, conduit fittings, and other electrical materials and accessories.

THE HENDON ELECTRIC LAMP CO., 104, Southampton Row, W.C.1.—A price list of "Hendon" lamps, including low-voltage patterns.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—Folder No. O.S. 3171, containing prices of automobile lamps; Leaflet No. O.S. 3,020, advertising "Osram" lamps for decorative purposes; and Leaflet No. 3,221, dealing with Christmas tree lamps.

THE CRESSALL MANUFACTURING CO., 40 and 41, Staniforth Street, Birmingham.—Two cards bearing samples of the firm's products. One with eight lengths of resistance cord, consisting of alloy wires wound on asbestos; and a miniature heating net with two pairs of tappings.

MESSRS. F. & H. MELEN, LTD., Express Works, Cheapside, and Sherlock Street, Birmingham.—List No. 103, illustrating and describing carrier tricycles and bicycles.

**Calendars and Diaries.**—The calendar sent us by Messrs. ERSKINE, HEAP & CO., LTD., Broughton, Manchester, bears an attractive picture of an auburn-haired lady, and monthly date sheets.

A calendar with a date-marking device has been received from Messrs. FRANCIS POLDEN & CO., LTD., 56, Cannon Street, E.C.4.

Mr. J. H. FLEMING, 315a, Stretford Road, Manchester, has sent us a neat calendar of the "perpetual" pattern, with changeable cards.

A calendar received from WESTINGHOUSE ELECTRIC INTERNATIONAL CO., 2, Norfolk Street, Strand, W.C.2, bears a beautifully-coloured picture of a lady artist at work on a decorative lamp-shade.

We have received a desk calendar from the UNIVERSITY ENGINEERING COLLEGE, Westgate-on-Sea.

**Book Notices.**—Circular No. 56 of the U.S. Bureau of Standards, "Standards for Electric Service." (Pp. 344.) Washington: Government Printing Office. Price 60 cents.—A tremendous mass of information regarding the regulations of the various States of the Union is contained in this volume, and the aim of the circular appears to be an attempt at the co-ordination of these. The regulation of electric light and power service by State commissions (states a summary) must be based on knowledge of the technical engineering factors entering into such service. Among these are station operation, distribution, metering, utilisation, and provisions for safety. These factors are discussed, and on this basis a complete set of rules suitable for adoption by any State public utilities commission is presented. Three ordinances, suited to the needs of cities of different sizes, are also proposed. The circular is concluded with a bibliography.

Scientific Paper No. 477 of the U.S. Bureau of Standards, "Spectroradiometric Analysis of Radio Signals" (Pp. 31.) Washington: Government Printing Office. Price 10 cents.—This paper develops several practicable methods for the solution of the integral equation by which the energy distribution of electric radiation may be calculated.

Messrs. Kelly's Directories, Ltd., are publishing shortly a directory devoted exclusively to the electrical industry, wireless and allied trades; price 30s. post free.

"The Gas Salesman's Diary and Handbook, 1924." (Pp. 200.) London: Walter King, Ltd. (*Gas Journal*). Price cloth, 3s. 6d.; paste grain leather, 5s.—This publication contains a great deal of information of use to the gas salesman, and, as was to be expected, the expensiveness of electricity is the keynote of numerous comparisons. It leads one to think that the rapid progress of electricity may, after all, be yet another phase of post-war extravagance. There may be other explanations!

"Elements of Storage Batteries,'" by C. M. Jansky and H. P. Wood. Pp. x+241; 148 figs. Price 12s. 6d. "Principles and Practice of Telephony," by J. G. Mitchell, in five vols.; the first three now published are: "Circuit Elements and Power," Pp. vii+300; figs. 722. "Principles and apparatus." Pp. vi+251; figs. 98. "Toll Equipment Traffic and Trunking," Pp. vii+290. Price 12s. 6d. each volume. London: McGraw-Hill Publishing Co., Ltd.

**New Italian Companies.**—There has been formed at Portomaurizio the Società Tramvie Elettriche Provincia di Portomaurizio, with a capital of 600,000 lire, for the working and installation of electric tramways.

The Società Anonima Garigliano has been embodied at Rome for works of irrigation, the generation and distribution of electricity, &c. Its capital is 500,000 lire.

**New Zealand's Import Trade.**—A *Board of Trade Journal* summary of the import trade of New Zealand in the September quarter of last year shows that the total value was £10,291,063, as compared with £8,913,137 in the equivalent period of 1922. Among the factors operating to bring about this improvement was an increase in the value of electrical and agricultural machinery imported.

**Imperial Conference Recommendations.**—The Council of the British Empire Producers' Organisation has passed a resolution expressing the opinion that it is of vital importance to the future unity and development of the British Empire that the leaders of the three great political parties in this country should agree upon those recommendations of the Imperial and Imperial Economic Conferences which may be regarded by them as not inconsistent with the programmes of their respective parties, with a view to giving agreed legislative effect to those recommendations at the earliest possible moment.

**Co-Partnership.**—On Tuesday last, January 15th, Mr. E. W. Mundy, secretary of the Labour Co-Partnership Association, delivered a lecture on this subject before the Society of Technical Engineers at its headquarters, 102, Belgrave Road, London, S.W.1.

**British Empire Exhibition Note.**—According to official estimates 30,000,000 people from all parts of the world are expected to visit the British Empire Exhibition, and of these, large numbers will stay in or near London for more or less lengthy periods. Messrs. Thomas Cook & Son, of Ludgate Circus, E.C., and Messrs. Whitfield, Baker & Co., of Pall Mall, W., are between them dealing with the whole question. Hotel, boarding house and apartment resources in London and many of the seaside resorts comparatively near, are now being classified and organised. As chief official passenger agents to the exhibition Messrs. Cook are arranging special tours from all parts of the Empire, and there is to be a great June to September escorted tour from South Africa.

**The Market for Electrical Goods in Turkey.**—The American Vice-Consul in Constantinople takes an optimistic view of the possibility of selling electrical equipment and supplies of nearly every kind in Constantinople and district. He admits, however, that the more extended use of electrical methods must wait upon the greater production of the necessary current. In his opinion, with Turkey's return to normal conditions, there will undoubtedly follow a rapid development of the country's hydro-electric resources.

In view of the fact that the local electric tramway and supply company is under Belgian control, and that, therefore, mainly Belgian materials are used, the Vice-Consul assumes that minor supplies for house wiring, together with lighting fixtures and accessories, will offer the best selling opportunities. There are numerous supplying stores and agencies which might, in addition, be able to do a considerable transit trade. It is claimed that local stocks of electrical appliances are nearing exhaustion, and the Vice-Consul believes that in spite of German competition, there would be a market for such specialities as electric water heaters, fans, electric cooking ranges, individual electric light plants, dry batteries, flash lamps, and vacuum cleaners. Incandescent lamps for 110 and 220 volts form one of the chief items of import and the demand is said to be fairly constant.

Prices of electric motors vary from 60 Turkish pounds (£7 approximately) for the ¾-h.p. size to 1,500 Turkish pounds (about £200) for those of 100 h.p. Incandescent lamps of all well-known makes are on the market, their cost being 35 to 40 piastres (10d. to 1s.) for 25-watt sizes, and 75 to 85 piastres (2s. to 2s. 6d.) for 100-watt lamps. Sockets are of the screw type for lamps, though appliances are usually connected to outlets by means of pin plugs of the usual European type. The following table gives current prices of miscellaneous electrical appliances:—

| | £ s. d. | £ s. d. |
|---|---|---|
| Portable heaters ... ... ... | 1 10 0 | to 1 17 6 |
| Fans ... ... ... ... ... | 3 0 0 | to 6 0 0 |
| Egg boilers ... ... ... ... | 1 0 0 | |
| Toasters ... ... ... ... | 1 5 0 | |
| Samovars ... ... ... ... | 3 15 0 | to 4 4 0 |
| Irons ... ... ... ... ... | 0 11 6 | to 0 16 0 |
| Curling irons ... ... ... | 0 13 0 | to 0 16 0 |
| Water heaters ... ... ... | 0 12 6 | to 1 2 6 |
| Milk heaters ... ... ... | 0 12 6 | to 1 2 6 |
| Soldering irons ... ... ... | 0 11 6 | to 0 13 0 |
| Hair driers ... ... ... ... | 1 17 0 | to 2 0 0 |

**Russian Electrical Contracts in Western Europe.**—Two of the directors of the Russian Electrical Construction Committee, which was constituted at Moscow for the purpose of carrying out the Lenin scheme for the electrification of Russia, have recently been staying in Paris. One of them has now returned to Moscow, while the other, M. Joukoff, is said to be remaining in the French capital for the present. The object of the visit has been to ensure the supply of machines and apparatus which can no longer be purchased in Switzerland seeing that the latter is now boycotted by the Soviet Government as a result of the acquittal of Conradi. According to statements supplied by the directors to a Paris newspaper, since the preparation of the Lenin scheme in 1918 six central stations have been erected or are in course of construction. In the case of one of these stations—the Shatursk works—the electrical plant for the two turbines already installed is stated to have been furnished by the Metropolitan-Vickers Co. Discussions have been opened with English firms for the electrical equipment of the Shterovka station which is to serve the Donetz coal basin, and for the supply of a turbo-generator of 10,000 kW for the Krassny Oktiaber station near Petrograd.

**Swiss Engineering Industry and Canada.**—The invasion of Canadian markets by Swiss manufacturers of machinery is presaged by the visit to Canada of M. E. Wolgensinger, of Zurich, who, representing one of the largest manufacturers of turbines and other industrial machinery, will endeavour to revive pre-war business connections.—*Reuter's Trade Service* (Toronto).

**New Showrooms.**—MESSRS. RICHSON & CO., LTD., opened some time ago new showrooms at 113, Oxford Street, W.1, for the display of their Czecho-Slovakian glassware, art-metal, and silk for illumination and other purposes. The main showroom is on the street level, and a shop-window with ample space has been tastefully arranged; the remainder of the exhibits are in the basement. The display consists of hundreds of designs of bowls, chandeliers, standards, and other lighting accessories distinguished by their beauty and originality. Any description of such a collection is necessarily inadequate; the only means of gaining a complete idea of the variety and artistry of the display is a visit of inspection.

SWANSEA.—A photograph of the showroom recently opened by the Corporation Electricity Department shows this to be well lighted and tastefully arranged. A prominent display of lighting fittings appears among appliances of all kinds. The quantity of electrical devices exhibited precludes a satisfactory reproduction of the photograph.

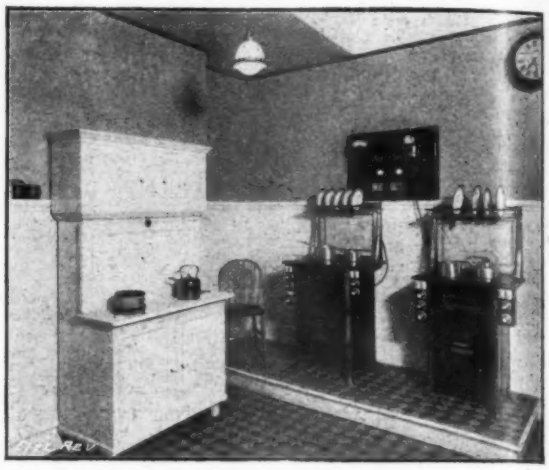


FIG. 1.—THE HALIFAX "KITCHEN."

HALIFAX.—The Corporation Electricity Department showrooms, which were opened a short time ago, are arranged on the lines of a dwelling house, which is probably the best way to display electrical appliances. The photographs which are reproduced herewith show part of the kitchen (fig. 1) conveying an atmosphere of cleanliness, and (fig. 2) a corner of the lounge, in which comfort is manifest.

FIG. 2.—A CORNER OF THE LOUNGE.

**German Goods for Ireland.**—At the meeting of the Council of the Cork Chamber of Commerce, last week, a letter was read from the German Consul-General, in Dublin, inquiring as to any firms in Cork City who would be prepared to handle German-made goods, such as electric motors for textile and other industries, electrical fittings, gas fittings, automatic machines for the manufacture of wire goods, cutlery, hardware, &c. It appears to be the desire to push electrical appliances and machinery apparatus in the Irish Free State.

**British Engineering Industries.**—The *Bulletin* of the Federation of British Industries in its first issue of the new year published a brief review of the engineering industries. It finds it somewhat difficult to give a really fair survey of the trade throughout the country. "The situation varies from district to district, and even in the same district it is found that some firms are able to report fairly good business while others are almost at a standstill. In the main, however, it appears that the position is slightly more promising than it was a year ago, although a very rapid revival all round cannot be anticipated. The one outstanding feature is that the Board of Trade returns for November show an increase of 1¾ million tons in the exports of iron and steel. This is a very healthy sign. There are also a number of development schemes which will probably entail the use of a considerable amount of engineering products. In particular, mechanical and electrical engineers are doing considerably better than they were a few months ago, and to a large extent the same is true in most of the metal work branches. A disturbing feature is the irregularity in the price of raw and semi-finished products. On the whole it would appear as though prices are tending upwards, but the movement is not uniform. Our two chief competitors at the moment appear to be Belgium and France, and there is no doubt that both of these countries are steadily increasing their output and are often able to sell at figures with which we can hardly hope to compete. In view of the uncertainty of the position considerable anxiety is being caused in the engineering trades at the advance in the price of coal. It is recognised that colliery owners have by no means had an easy time lately, and, in addition, have heavy losses to make good, but on the other hand, by the increase in price of coal, engineering trade will be heavily handicapped, and Continental firms may be enabled to obtain contracts which otherwise would come to us. . . . . The increased activity in shipbuilding has benefited the British metal trade, but as yet it is too early to anticipate any considerable orders for brass and copper fitments. Undoubtedly the revival of trade has been assisted by the substantial reduction in price which has taken place during the last year. . . . During November the volume of business in the machine-tool industry appears to have been greater than in any month since December, 1920, though the amount is still very far below the productive capacity of the industry. A ballot of the members of the Machine Tool Trades Association was taken as to the desirability of seeking to secure that protection by tariff should be accorded to the industry. The voting was roughly 8 to 1 in favour. . . . The disturbed state of affairs in Germany does not appear to have restricted the exports of machine tools from that country to Great Britain."

**New Spanish Company.**—With a capital of 4,000,000 pesetas the Sociedad Española de Tranvias y de Electricidad has been formed at Bilbao with the object of working a network of tramways in Alicante.

**Unemployment.**—There was an increase of 113,120 in the number of registered unemployed on December 31st, the total being 1,250,100. During 1923, however, there was a total reduction of 235,800 in the number of persons registered as totally unemployed. There was a decrease of 1,500 in the number of short-time workers, the total on December 31st being 52,900. The decrease during 1923 was 3,360.

**The Position of German Engineering Industry.**—The *Deutsche Allgemeine Zeitung* says that the last month of 1923 brought little change in the difficult situation of the German engineering industry. In some cases complaints are still being made of lack of raw materials, especially rolled iron. The prospects of coal and coke supplies are considered very dark in some quarters. Exports of machinery, which, on account of the currency question and the urgent necessity of improving Germany's balance of trade, are of great importance, might be greatly encouraged by a reduction in freight rates. As an instance it may be mentioned that the freight rates for agricultural machinery from Central Germany (Leipzig) to Passau and the Dutch frontier are three times the pre-war charges (in gold marks), for ordinary consignments to Hamburg 3.2 times, and for overseas consignments six times the pre-war rate. Insufficient inquiries for machinery are being received both from home and abroad, in fact, a considerable number of firms were worse off in this respect than in the preceding month. Orders are altogether inadequate and short-time working has had to be maintained and more workers have been dismissed. The machinery industry is especially desirous of a settlement of the question of reparations and the 26 per cent. duty on deliveries to Great Britain, for which the Reich no longer makes any payments. Owing to the stabilisation of the currency, salaries and wages have not risen any further and in some instances it has been possible to reduce them not inconsiderably.—*Reuter's Trade Service* (Berlin).

**Copper and Lead Prices.**—Messrs. F. Smith & Co. report January 14th:—Copper (electrolytic) bars, £67, 10s. decrease; do. do. sheets, no change; do. do. wire rods, £77, 10s. decrease; do. do. h.c. wire, 9¼d., 3-16d. decrease; silicium bronze wire, 1s. 0¼d., ¼d. decrease.

Messrs. James & Shakespeare report January 15th:—No change in prices for copper bars, sheet and rod and English pig lead.

**The Chinese Industrial Mission.**—We referred in our last issue to the visit of the Chinese Industrial Mission, of which Mr. Chang Chien, Junior, is the head. *The Times*, in its "City Notes," reports that the Mission was entertained at luncheon at the Salters' Hall, London, on January 9th by Mr. R. L. Barclay, chairman of the Council of the London Chamber of Commerce, and Mr. Frederick Anderson, chairman of the Far Eastern section of the chamber. Those present included the acting Chinese Ambassador, Sir John Jordan, Sir Newton Stabb, Mr. Stanley Machin, Mr. E. B. Tredwen, and Sir John Denison-Pender. The Mission, having already visited France, Belgium, Holland, Germany, Italy, and Switzerland, is spending about three weeks in England studying the textile, coal mining, shipping, road-building, agricultural machinery, railway, motor, and shipbuilding industries. It is hoped by the visitors that they will be able to enlist the support of British capitalists as well as traders. "One of the greatest hindrances to the development of China is the relatively poor means of communication, and if road construction were taken seriously in hand China would become a large user of motor-cars. After leaving the United Kingdom the Mission will proceed to the United States. Members of the Mission are all technical men, and their visit provides an excellent opportunity for developing the trading relations of the two countries."

**Ediswan Contracts.**—The following contracts have been secured by the Edison Swan Electric Co., Ltd.:—

London, Midland & Scottish Railway.—Gasfilled lamps.
Royal Mail Steam Packet Company.—Part contract for metal and carbon-filament lamps.
London & North-Eastern Railway.—Metal-filament lamps.
Great Western Railway.—Gasfilled lamps.
War Office.—Inert cells.

**Membership of District Council.**—It was reported at the meeting of District Council No. 2, Electricity Supply Industry, on January 9th, that York had decided not to rejoin the Council. On the other hand, it was stated that Halifax intended to rejoin.

**The Parliamentary Industrial Group.**—The *Manchester Guardian* states that on January 9th the Parliamentary Industrial Group met at the House of Commons and elected the following officers for the session: Chairman, Sir Arthur Shirley Benn; hon. secretaries, Mr. Grattan Doyle, Captain Bowyer, Captain W. Brass, and Mr. P. J. Hannon; committee, Sir Philip Dawson, Sir Fred Hall, Mr. Lorimer, Sir Philip Richardson, Mr. W. Raine, Sir Henry Cowan, Mr. G. Balfour, and Sir Philip Pilditch. The chairman and Mr. Hannon subsequently waited upon the Chancellor of the Exchequer to place before him considerations regarding the industrial outlook.

**Trade Mark Applications.**—The following are among the recent applications for British trade marks. Objections may be entered against any of the proposed marks within one month from the dates mentioned. In the case of foreign applications the names and addresses of the British representatives are also given.

Amplionette. No. 442,667. Class 8. Telephonic apparatus. Edward A. Graham, trading as Alfred Graham & Co., St. Andrews Works, Crofton Park Road, London, S.E.4. January 2nd, 1924.

Duric. No. 441,606. Class 8. Instruments and apparatus for use in wireless telephony and telegraphy. Radio Acoustics, Ltd., 175a, Peckham Park Road, London, S.E.15. January 9th, 1924.

Crystavox. No. 441,876. Class 8. Apparatus for use in wireless telegraphy and telephony. S. G. Brown, Ltd., Victoria Road, North Acton, W.3. January 9th, 1924.

Liplite. No. 443,084. Class 8. Crystal detectors for wireless telegraphy and telephony. Reginald Bond, 7, Baden Place, Crosby Road, London, S.E.1. January 9th, 1924.

Elka (lettering and design). No. 431,105. Class 13. Electrical contacts and terminals, electrical fittings, fusible cut-outs, &c. Liesegand & Kosch Gesellschaft, 15-19, Monckebergstrasse, Hamburg, Germany. (W. Fairburn Hart, 13, Bond Street, Leeds.) January 9th, 1924.

Vega. No. 442,875. Class 13. Electric lamps (ordinary). Etablissements Michel Potus, 41, Rue Saint Ferdinand, Paris. (Chatwin & Co., 253, Gray's Inn Road, London, W.C.) January 9th, 1924.

**Social Events.**—On Saturday, January 5th, the directors and staff of Messrs. Fuller's United Electric Works, Ltd., of Chadwell Heath, met at the Liverpool Street Station Hotel, for the annual staff dinner. Mr. Francis R. Wade, O.B.E., M.I.M.E., chairman of the company, occupied the chair. A short toast list was supplemented by an enjoyable musical entertainment, arranged by Miss Mollie Fuller, L.R.A.M.

The annual dance of the staff of the Newcastle-on-Tyne Electric Supply Co., Ltd., and its associated companies was held at the Heaton Assembly Hall, Newcastle, on January 7th. The guests were received by the chairman of the companies, Mr. R. P. Sloan, C.B.E., and his sister. Many eminent electrical men and their ladies were present. Music was provided by Mr. Harry Tuff's orchestra, and an excellent dance programme was gone through. Supper was served during an interval, and the dance was resumed and carried on until one a.m. The enjoyment of non-dancers was fully catered for.

**Annual Dinner.**—At the Café Royal, Regent Street, W., on January 12th, the staff of the Osram Lamp and Wireless Valve Works (General Electric Co., Ltd.) gathered for their annual dinner. Mr. C. Wilson occupied the chair and Mr. Hugo Hirst (chairman of the G.E.C.) and other directors were present, as well as a number of guests, including Sir Arthur Steel-Maitland. An excellent dinner and musical programme were provided. After the loyal toast Mr. W. L. Giller proposed the health of "The Firm," referring to the great improvement in organisation which had taken place in the last year or two. Mr. Hugo Hirst, replying, deprecated the use of the word "firm" in connection with such a vast organisation as the G.E.C., and traced the rapid growth of the company's various branches. He said that it was their aim to make the G.E.C. second to none of the large American and German combinations. He was anxious to see the loyal co-operation between the lamp works staff and the research department extended to the whole of the many sections of the company. Mr. L. C. Pennell, in proposing the chairman's health, paid an excellent tribute to Mr. Wilson's valuable work, and the chairman responded by saying that the success attained was due to the mutual confidence which existed between him and his staff. Mr. Driver, whose name was coupled with that of the chairman, also replied briefly, and, later, proposed the health of "The Visitors and Press." Sir Arthur Steel-Maitland responded and referred to the importance of the G.E.C. to the electrical industry. Mr. S. Rentell acknowledged the toast on behalf of the Press.

**Local Exhibition.**—STOKE-ON-TRENT.—A Heat, Light, and Power Exhibition is to be held from April 24th to May 3rd under the auspices of the Electricity and Gas Departments of the Corporation. The exhibition will cater for a large industrial district with a population of over half a million, and a low rate is being charged for space, two factors which should make for success.

**Large Turbine Contract.**—The hydro-electric department of Messrs. Vickers, Ltd., has received an order for the largest single-runner Francis water turbine which has been built in England. This is a 25,000 h.p. water turbine, to be installed at Calumet Island, on the Ottawa River, in Canada. At the point where the power station is now under construction the river falls 60 ft., and eventually three sets, such as the one now on order, will be installed.

**Automobile Wires and Cables in Canada.**—His Majesty's Trade Commissioner at Toronto (Mr. F. W. Field) has forwarded to the Department of Overseas Trade particulars from the Handbook of the Society of Automobile Engineers (Inc.), New York, showing the Society's standards and recommended practices with regard to cable terminals, insulated cables, ground return wiring system, cable conduit, tubing clips, and rubber bushings, and states that the Canadian Engineering Standard Association, Ottawa, has not as yet issued specifications on these materials. The Trade Commissioner adds that automobile practice in Canada is entirely in accordance with the methods usual in the United States, and automobile production is practically controlled by United States firms. He has been advised by the Secretary of the Canadian Association that it is extremely unlikely that standards other than those accepted in the United States would find wide acceptance in Canada. The extracts from the handbook in question, together with samples of the wires and cables in general use by the automobile industry in Canada, can be inspected by United Kingdom firms interested at the Department of Overseas Trade (Room 52), 35, Old Queen Street, London, S.W.1, up to February 1st, after which they will be available for loan, in order of application, to those firms who are unable to inspect them at the Department.

**United States Electric Vehicle Market.**—Electric truck manufacturers were more active during the month ended December 21st, 1923. A contract for 50 trucks placed by a Newark (N.J.) pastry concern was the largest order booked. This company found that it could deliver a dollar's worth of pies for 6½ cents, as compared with 13 cents when delivered by gasoline-propelled trucks or horse vans. The next largest order was for ten 5-ton trucks, received by a well-known truck company which manufactures gasoline and electric vehicles. One of the largest truck makers in Chicago recently completed additions to plant in order to handle increased business. A report from San Francisco states that sales of electric trucks in that district have increased 35 per cent. during the past year. More than 30 electric trucks were sold in Chicago during November, 1923.

A meeting of the Transportation Bureau, Commercial National Section of the National Electric Light Association, was held in Salt Lake City, Utah, late in November, under the chairmanship of Mr. Charles R. Skinner, Junior, head of the Automobile Bureau of the Edison Electric Co., of New York. The purpose of the meeting was, primarily, to explain the advantages of the electric truck to Western representatives of the various electrical companies in that region.

The first session of the Electric Truck Instruction Course was held in New York recently. There was a full attendance of drivers of electric trucks and garage attendants to hear a lecture on the subject of chassis.

Thirteen electric trucks and passenger cars, valued at $18,712, were exported from the United States during October, 1923.—*Reuter's Trade Service* (New York).

**The Keighley Plant Contract.**—At the annual dinner of the Keighley Association of Engineers last Saturday reference was made to the foreign competition for the Keighley electricity works extension plant. According to the report in the *Leeds Mercury*, Sir Robert Clough, in proposing the toast of the "Town and Trade of Keighley," said that to benefit the trade of Keighley and other business centres, his advice to British purchasers would be: Buy British goods first; buy Empire products next; and then, if it is something non-competitive, buy foreign goods, but even then only where our money is accepted at not less than its par value. The Mayor (Mr. Robert Calverley) remarked that there seemed to be considerable talk in the town about the extension of the electricity concern and the question of the tenders for new plant in connection with which a Swiss firm was in the running for the contract. The Electricity Committee was not doing anything hurriedly. What the result would be he was not prepared to say; but, at any rate, they could rest assured that if the work could be kept at home it would be. At the same time, 25 per cent. difference in price was a very serious matter, so far as the ratepayers of the town were concerned.

**Sweden's Export Trade.**—The *Swedish Economic Review* (a Government publication), for December contains an analysis of the export trade of Sweden during 1922, so far as "mechanical products" were concerned. The term includes cutlery and tools, ball-bearings, locomotives, munitions, separators, internal combustion and steam engines, electrical machinery, telephone and telegraph apparatus, and "other machinery and instruments." Of a total of 179.8 million kroner, Great Britain is credited with 6 per cent., Norway with 10 per cent., Russia with 34 per cent., and Europe generally with 85 per cent. Exported electrical machinery was valued at 15.4 million kr. Europe as a whole took 64 per cent., Great Britain and Spain 10 per cent. each, and Norway 17 per cent. Of telephone and telegraph apparatus valued at 8.3 million kr., Russia took 21 per cent., the Netherlands 33 per cent., and Great Britain 2 per cent.

**Poland During 1923.**—A review of conditions in Poland during 1923 by the Commercial Secretary at Warsaw (reproduced in the *Board of Trade Journal*) states that the country continued to suffer from the effects of inflation, and all industries were adversely affected by the tightness of money, labour troubles, and the Government's policy of economy. Many industries, however, made good progress. The telegraph and telephone services were extended and improved during the year, and good progress was also made in radio-telegraphy between Warsaw and the more important industrial centres of the country. A station for direct communication with the United States was opened in November.

**The Canadian National Exhibition.**—The Federation of British Industries announces that it has taken three times the previous space at the Canadian National Exhibition, which is being held later in the year. As a consequence the Federation has been enabled to reduce the charge for space to member firms and a successful display is anticipated. It is necessary to give notice of intention to exhibit at the earliest possible moment.

**Capital Issues in 1923.**—From a list compiled by the Midland Bank, Ltd., it is seen that the total capital raised during the past year was less than in 1922. Electric light and power issues, however, showed a very satisfactory increase—from £3,239,517 to £9,923,666. Both the tramways and omnibuses, and telegraph and telephone groups were lower, the figures being, respectively, £961,278 (£1,654,516 in 1922), and £890,000 (£2,339,800). Industrial issues are not classified, but are shown as a whole. The total, £37,321,396, compared favourably with the 1922 figure, £25,869,269. The figures exclude all Government borrowing, shares issued to vendors, the capitalisation of reserves, and simialr transactions.

**For Sale.**—Holmfirth Urban District Council has for disposal a gas engine and producer plant, d.c. generator, switchboard, booster and balancer, also a quantity of d.c. motors, meters, fans, &c. Torquay Corporation Electricity Department has for disposal three Belliss & Morcom compound engines, each coupled to a 100-kW, d.c. generator, one surface condensing plant, &c. Messrs. H. Butcher & Co. will sell by auction, on January 23rd and following day, at 556, Oxford Street, W., a quantity of electrical accessories; by order of the receiver for the debenture holders of the Willesden Electric, Ltd. Messrs. H. Butcher & Co., in conjunction with Messrs. Chesterton & Sons, will sell by auction on January 29th, at 843-845, Harrow Road, Willesden, the electric lamp manufacturing equipment and stores, &c. Rugby Urban District Council invites offers for two steam generating sets. (See our advertisement pages to-day.)

**Electrical Industry of the Argentine.**—In October last the Argentine Republic celebrated the fortieth anniversary of the establishment of the electrical industry in that country, and the capital invested in electrical undertakings is estimated at over 500,000,000 pesos at the present time. Thirty-one of the principal companies, situated in the capital and the larger cities, now stand for 28,906,926 gold pesos and 43,315,047 pesos of legal currency; this amount is apart from that invested in electric railway undertakings and their rolling stocks and plant. Apart from the evident prosperity thus shown the benefits indirectly accruing to the general industries of the Republic cannot be too highly appraised.

# The Electrification of Taymouth Castle.

### A Transformation in the Scottish Highlands.

By "OTHELLO."

In these days it is not a matter for surprise to find electricity unobtrusively performing its gargantuan tasks in the most remote spots. So, to the remote fast-

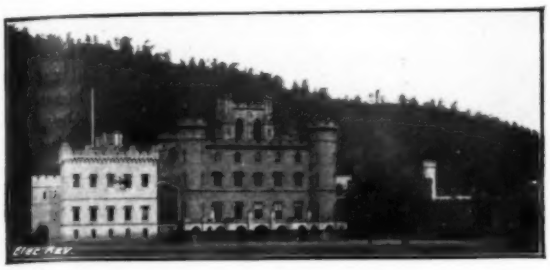


FIG. 1.—TAYMOUTH CASTLE.

nesses of ancient nobility which have seen their sombre and formidable walls dimly lighted by the tallow dip, comes soft and radiant light, always ready power, the greatest domestic servant—electricity.

Such a transformation has been made at Taymouth Castle. Until recently the seat of the Lords of Breadalbane, in historical surroundings at the east end of Loch Tay, in Perthshire, the old castle has been brightened and modernised by electricity derived from a harnessed stream.

The original castle, or Old House of Balloch or Bealoch, meaning in Gaelic "the house at the narrow pass," was built in 1573, but the present Taymouth Castle was erected on the site of the old castle 122 years ago. Recently the castle has been converted into a modern hotel, all of the public rooms, with their magnificent fittings, carvings, and historical associations, having been left in their original condition.

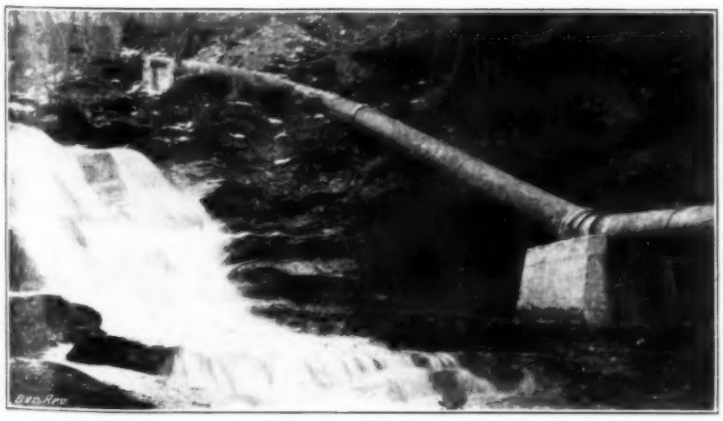


FIG 2.—PIPE LINE.

In the task of modernising this huge building perhaps the largest and most important undertaking was the electrical installation and the erection of the hydro-electric plant.

Three quarters of a mile from the castle there existed the remains of an ancient mill-house, partially destroyed by fire many years ago. On this site a power house has been erected, the water turbine being driven by an insignificant burn which runs down the hillside, having its source at the loch on the high land some two or three miles away. Three hundred yards above the power house the water is diverted by a wooden flume into an earthen dam, originally used for the old mill-wheel, but now strengthened and enlarged, whence the water is conveyed in a 16-in. steel pipe 600 ft. long, which is supported over difficult and rocky ground on concrete piers.

A 50-h.p. impulse turbine of a comparatively new type manufactured by Messrs. Gilbert Gilkes & Co., of Kendal, is at present installed, but a static head of 140 ft. is available, and the pipe has sufficient capacity

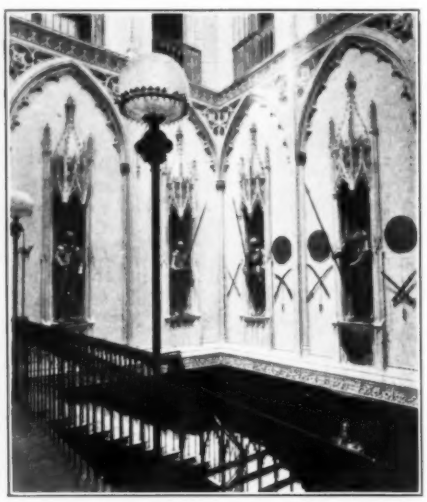
FIG. 3.—BARON'S DINING HALL.

to supply another similar turbine, which may be installed at some future date.

The turbine is coupled direct to a 30-kW, 240/250-volt, 520-r.p.m. dynamo, suitably compounded to compensate automatically for voltage drop in the long transmission line between the power house and the castle. It runs very steadily, notwithstanding the fact that it has no flywheel to compensate for variations in load, thus proving the reliability of the governor with which it is fitted. A water economiser is provided, which is so efficient that the water consumption at no load is only 7½ per cent. of that at full load.

Even in the Scottish Highlands an extra dry season may occur at some time or another. With this perhaps somewhat remote eventuality in mind the promoters of the scheme have installed a stand-by set, consisting of a Tangye horizontal Diesel

crude-oil engine having an extra large and heavy fly-wheel to ensure steady running. It is cold starting and is capable of developing 60 h.p. at 210 r.p.m., and will belt drive a dynamo exactly similar to, and interchangeable with, that driven by the water turbine



FIGS. 4 AND 5.—NORTH CORRIDOR AND GRAND STAIRCASE.

The switching arrangements permit the turbine and engine sets to be run singly or in parallel if required, although it is intended that the engine shall be used only in periods of water scarcity, or when the turbine is laid by for inspection, or for other reasons. The power-house main switchboard, by Messrs. W. C. Martin and Co., is of polished enamelled slate, each generator and feeder circuit being provided with circuit-breaker protection.

All main cables radiating from the power station are of Henley manufacture and are laid underground, that to the castle being nearly three quarters of a mile in length and over 15 tons in weight. To minimise voltage drop and to provide for extensions in the use of electricity, this cable has sufficient capacity for all probable future requirements.

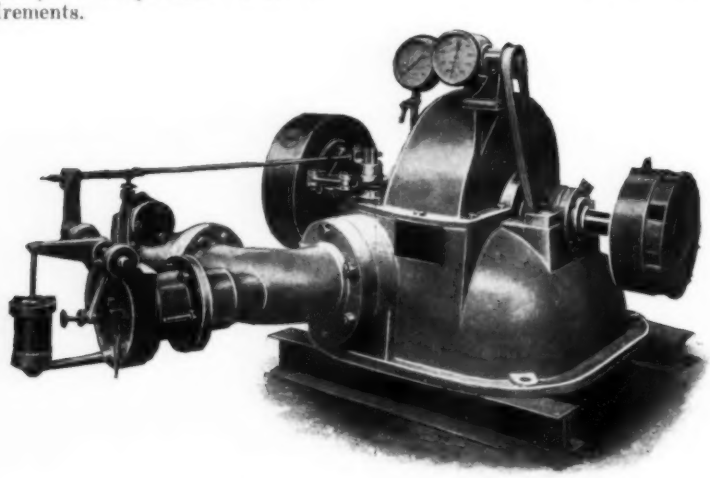


FIG. 6.—WATER TURBINE.

Inside the castle everything which electricity can do for comfort and convenience—and what, indeed, can it not do?—is done. One unique feature is a series of unobtrusive electric signs which direct the guest to the apartment or section he is seeking. In a fine old building of the size of Taymouth Castle it is not an easy matter to find one's way about, and these signs represent a bright thought for which their authors are to be commended. Dinner gongs, operated electrically from the office, call the guests to meals from various rooms, and food is carried from the kitchen to the servery on electric elevators; potatoes are peeled, plates washed, steaks grilled, bread toasted, afternoon tea or ice cream made, rooms cleaned, aired, ventilated, and warmed—all by electricity.

Every bedroom has, in addition to the usual lighting fittings, a socket for connecting a reading lamp, vacuum cleaner or electric radiator. In the public rooms the lighting has been carefully studied and beautiful results are attained. The fittings are designed to harmonise with the fine old interior decorations, and not an inch of the wiring, which has been carried out with the Henley system throughout, is to be seen, except in some of the outbuildings. This applies to the various networks for light, bells, telephones, gongs, fire

FIG. 7.—BANNER HALL, WEST SIDE.

alarms, and power appliances, and it is interesting to note that some 40 miles of internal cable have been used in the installation.

A specially designed system of bells enables the hotel office to ascertain that all calls are being promptly attended to and to register them on a central indicator, for convenience in night working.

The telephone system enables the manager to get in touch with any part of the house, garage, or power station at a moment's notice, a central exchange being fitted in the office. In the event of fire, an extensive system of automatic fire alarms throughout the castle (with an indicator and fire gong in the office) would give warning.

To the consulting engineers, Messrs. Thos. Young, Son & Miller, of Glasgow, to whose specification the work was carried out, commendation is due, and the contractors, Messrs. W. C. Martin & Co., also of Glasgow, are to be congratulated upon the manner in which the work was done.

# An Electrically-Driven Shopfitting Establishment.

## Messrs. Pollard's London Works.

MR. EDWARD POLLARD commenced business as a shop fitter in the Kingsland Road in February, 1895, his employés then numbering six; four years later he moved to a new factory at Bethnal Green, and in February, 1901, the works were again removed into the Clerkenwell Road. In that year it was found necessary to organise an electrical department in order to take care of the maintenance of the factory plant, which at that time needed about 50 h.p. to drive it, and also to deal with the shop-lighting and shop-window illumination problems that arose in the course of the shop-fitting business. By February, 1907, the number of employés had increased to 1,500, and in 1911 a large factory was built in St. John's Square, which we recently had the pleasure of visiting.

It is somewhat surprising that such an extensive wood-working establishment should be located almost in the heart of the City of London, but it is pleasing to note that the premises are electrically lighted and all the machinery is electrically driven throughout; electric heating is also employed with advantage. Mr. S. W. Tucker is in charge of both the inside and outside electrical work.

Some idea of the size of the works is afforded by fig. 4, which is a view of a portion of the "setting-out" shop wherein every piece of work undertaken is "set out," full size, by draughtsmen who have passed through the various shops, it being thus made certain that the shops are not called upon to make anything that it would be difficult or awkward for the shop equipment to produce—an example that could be followed with advantage by some engineering designers and draughtsmen.

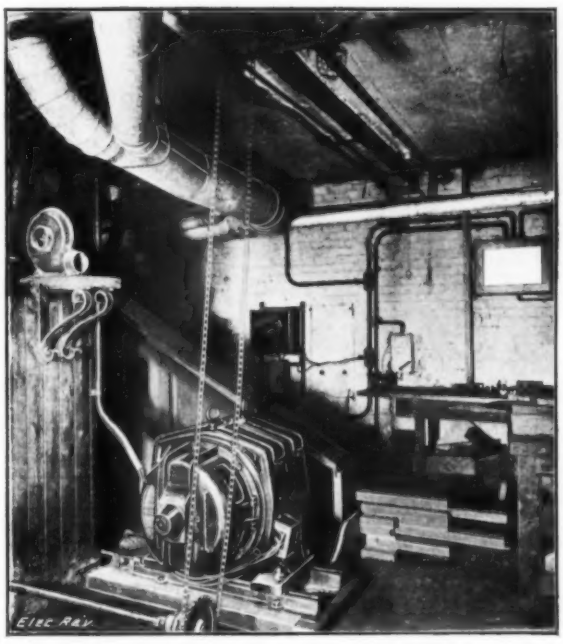
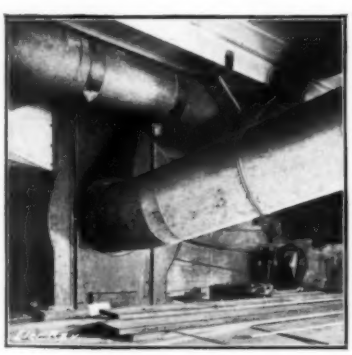
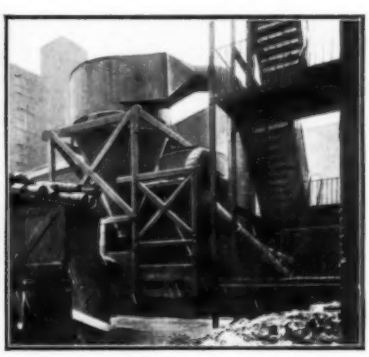


FIG. 3.—A 35-H.P. SHOP MOTOR.





FIGS. 1 AND 2.—A 45-H.P. FAN MOTOR AND STURTEVANT WOOD-REFUSE HOPPERS.

The factory at present contains some old motors of various makes, but Messrs. E. Pollard & Co., Ltd., have decided to install exclusively d.c. machines manufactured by Messrs. Newtons, of Taunton—now Rotax (Motor Accessories), Ltd.—on which they will standardise for the future. A typical drive is illustrated in fig. 3, which shows a 35-h.p., 530-volt, 950-r.p.m., d.c. Newtons motor driving, by means of belting and line shafting, a number of wood-working machines, such as a forecutter, sander, &c.; the chain seen hanging in the foreground is the means of controlling the fast and loose belt pulleys from the floor above.

Fig. 1 shows the Sturtevant fan with its 45-h.p., 870-r.p.m. Newtons shunt-wound motor, which draws the sawdust, shavings, and other wood refuse from the various shops through galvanised metal ducts and discharges it into the two hoppers at the back of the premises shown in fig. 2. All the switchgear for controlling the motors is of the "iron-clad" type and, together with the whole of the electrical gear, cables, instruments, &c., used in the new installation, was supplied by Messrs. Baxter & Caunter, Ltd.;

FIG. 4.—THE "SETTING-OUT" SHOP.

the angle-iron switchboard framework was, however, erected by Messrs. Pollard's own factory staff. The installation has a present capacity of about 1,000 kW, of which approximately 30 kW is used for lighting and 20

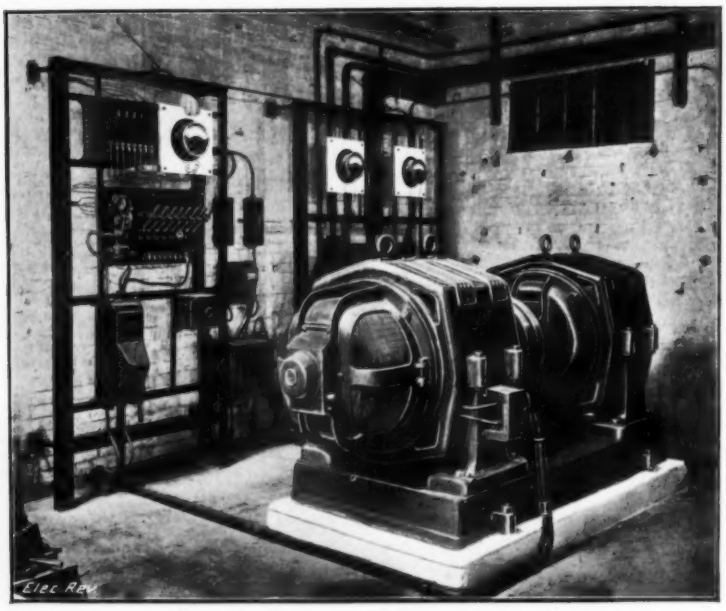


FIG. 5.—NEWTONS MOTOR-GENERATOR SET.

kW for heating in the form of a.c. at 105 volts, while the remainder is utilised for power purposes. Electricity is purchased from the County of London Electric Supply Co., Ltd., a change-over service being provided, but as an agreement could not be reached concerning the price to be charged for energy for lighting, an interesting arrangement was finally made. The County of London Co. eventually agreed to supply d.c. at 530

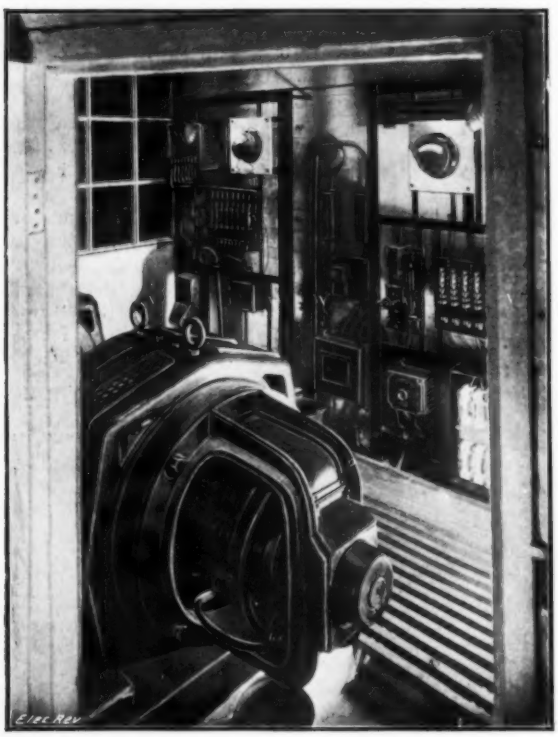


FIG. 6.—MOTOR-GENERATOR ROOM.

volts at a contract price, and Messrs. Pollard installed a motor-generator set which enabled them to utilise the power supply for lighting purposes.

The converting set is shown in figs. 5 and 6, and is also of Messrs. Newtons' make; it is rated at 50 kW at 600 r.p.m., is claimed to have a full-load efficiency of 88 per cent., and we understand saves the firm £5 per week for lighting alone, even when operating at ¾ load, as compared with what the cost would have been had the County of London Co.'s normal charge for lighting still applied.

The switchboard to the left in the background of figs. 5 and 6 controls the motor-generator, while that to the right controls the lighting circuits, which are divided into six. There is no flicker in the light, and as the voltage is under local control, decidedly better illumination is obtained from this machine than directly from the mains. The last illustration is a view of the incoming supply cables and a portion of the power supply cables; each power circuit is provided with d.p. ironclad Cantie 50- or 100-ampere switches, porcelain fuses, and a Whipp and Bourne circuit breaker, with the usual metering arrangements.

In conclusion, our thanks are due to Messrs. Pollard & Co., Ltd., for permitting us to visit and describe their factory, and to Mr. G. W. Kettlewell, a director of Messrs. Baxter & Caunter, Ltd., for his assistance in the preparation of this article.

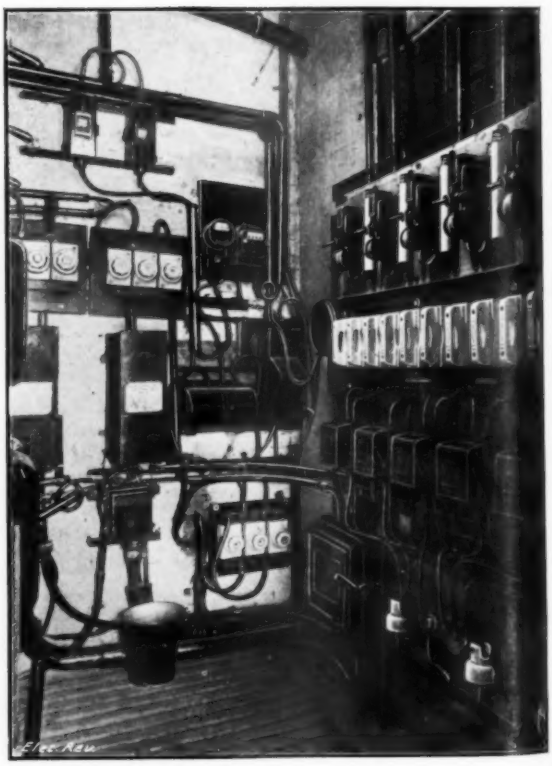


FIG. 7.—INCOMING CABLE ROOM AND POWER SWITCHGEAR.

The installation is of interest inasmuch as it constitutes an example of the application of electricity for power purposes under conditions that could not have been met by other means. The factory floor space is so valuable for production purposes that none of it could be spared to accommodate an oil- or gas-engine plant. Electricity has, therefore, once more proved to be the means of driving works machinery, which could not have been supplied economically with any other form of power.

# Lighting and Power Notes.

**Ashton-under-Lyne.**—EXTENSION OF SUPPLY.—The Corporation proposes to promote a Bill in the next session of Parliament authorising it, amongst other schemes, to supply electricity to the urban and rural districts of Hurst and Limehurst.

**Barrow.**—ELECTRICITY ORDER.—The Town Council is applying to the Electricity Commissioners for an Order authorising it to supply electricity in bulk to Ulverston and Grange Urban District Councils and other authorities, and to supply electricity in Ulverston rural district. Terms have already been arranged with the local councils.

**Barrow-upon-Soar.**—SPECIAL ORDER.—The Midland Electric Light and Power Co., Ltd., has applied to the Electricity Commissioners for a Special Order, authorising it to supply electricity in certain parishes in the Rural District of Barrow-upon-Soar and in the Urban District of Quordon.

**Canada.**—ELECTRICITY SCHEMES.—The British Columbia Electric Railway Co. will shortly award contracts for the first additions to its power plant on Stave Lake and River, which within the next few years will add at least 156,000 h.p. to the capacity of the company's system. The new power station will cost about $1,000,000, and the plant will include a turbine of 25,000 h.p. driving a generator of 18,000 kW.—*Reuter's Trade Service* (Vancouver).

The North Shore Power Company is preparing plans for a hydro-electric power station on River Batiscan, between Three Rivers and Quebec, to develop 5,000 h.p. The present power station will be demolished and the new one erected on the same site.—*Reuter's Trade Service* (Three Rivers, Quebec).

NIAGARA FALLS DEVELOPMENT SCHEME.—A new generating set with a capacity of 55,000 h.p. was brought into operation on January 8th. This brings the total development of the plant up to 330,000 h.p., all of which is now being utilised. Two further sets are being rapidly completed, while two more will be ready next year. When this plant is installed, the total development of the Niagara scheme will be 550,000 h.p.—*Reuter* (Niagara Falls).

**Dunoon.**—ELECTRICITY SUPPLY.—The Greenock Corporation has informed the Town Council that it is not disposed to undertake the distribution of electricity in Dunoon, but recommends that a supply in bulk be given at £8 per kW, plus 2d. per kWh, with a guaranteed minimum of 300 kW demand. The Town Council is to consider the offer.

**Formby.**—INAUGURATION OF ELECTRICITY SUPPLY.—The electricity supply for the district was recently inaugurated, and the Urban District Council has decided on the following charges:—Lighting, 8d. per kWh; power, up to the first 3,000 kWh, 4d. per kWh, and over 3,000 kWh, 3½d. The electricity supply is obtained in bulk from the London, Midland, and Scottish Railway Co.

**Fowey.**—ELECTRICITY SUPPLY.—The Town Council has decided to ask the St. Austell Electric Light Co. whether it intends to take steps to supply the town with electricity, and, if so, at what date it proposes to commence.

**Golborne.**—PROPOSED ELECTRICITY SUPPLY.—The Lancashire Electric Power Co. is seeking powers to supply the district with electricity for all purposes. The charge will be 6d. per kWh to householders, whilst special terms will be offered for lighting.

**Gourock.**—ELECTRICITY SUPPLY.—Electricity is now available in the town, the current being supplied by Greenock Corporation.

**Lancaster.**—LOAN SANCTIONED.—The Town Council has received the sanction of the Electricity Commissioners to the borrowing of £9,000 for mains.

**Lerwick.**—PROPOSED ELECTRICITY SUPPLY.—The Town Council has appointed a committee to consider the question of obtaining an electricity supply for the town.

**Liverpool.**—ELECTRICITY EXTENSION.—The Corporation has prepared an electricity extension scheme to cost £640,000.

**Luton.**—ELECTRICITY ORDER.—The Town Council has adopted a recommendation of the Electricity and Tramways Committee to apply for an Order to extend the area of supply so as to include Dunstable, Leighton Buzzard, Hitchin, Letchworth, Baldock, Stevenage, and parishes in the Rural District of Hitchin. For the supplies to Dunstable and Leighton Buzzard the estimated total cost is £38,010, and the Committee considers it practicable to supply Dunstable at the Luton tariff plus 25 per cent., and Leighton Buzzard, plus 33⅓ per cent.

**Maidstone.**—ELECTRICITY SUPPLY.—The War Office has accepted the offer of the Town Council to supply electricity to the Barracks at a flat rate of 6d. per kWh. Owing to the large outlay which would be involved, the Council has refused an application from the Ditton Parish Council for a supply of electricity to the parish.

**Manchester.**—LOAN.—The Electricity Committee has recommended to the Corporation that application be made to the Electricity Commissioners for sanction to the borrowing of £50,000 for mains.

**Nottingham.**—LOANS.—The Electricity Committee has recommended that application be made to the Electricity Commissioners for sanction to the borrowing of £90,000 for mains, transformers, switchgear and services, and £10,000 for meters.

**Price Reductions.**—Reductions in the charges for electricity have been made or recommended in the following districts:—

STOCKPORT.—Lighting and power: The increase over pre-war prices from 50 to 40 per cent., and in the case of consumers charged on the "Norwich" system, a reduction of 10 per cent., on the cost of electricity only.

FULHAM.—Lighting: From 5d. to 4½d. per kWh. Power and heating: From 1½d. to 1¼d. per kWh.

**Sheffield.**—ELECTRICITY EXTENSIONS.—The Electricity Committee has approved extensions to mains and works at an estimated cost of £5,363.

OVERHEAD WIRING TO HOUSES.—The Electricity Committee has recommended to the City Council that the lighting of the municipal houses on the Manor Estate be by means of overhead wiring at the discretion of the Committee.

**Stockport.**—NEW PLANT.—The Town Council proposes to expend £72,500 on the provision of a 12,000-kW turbo-generator, two boilers, and switchgear, for the electricity works.

**Taunton.**—NEW PLANT.—The Town Council has adopted a scheme involving the expenditure of £27,000 on new plant at the electricity works subject to the securing of a grant from the Unemployment Grants Committee. It is reported that the Electricity Commissioners are opposed to the continuation of the present non-standard frequency of 60 cycles per second, and advise a change-over to 50 cycles.

**Tring.**—ELECTRICITY SUPPLY.—The Urban District Council has been informed that the executors of the late Hon. N. C. Rothschild might be prepared to dispose of their electricity works to the Council. An expert is to inspect the works and submit a report upon this, and also upon a scheme proposed by Aylesbury Town Council.

**United States.**—ELECTRICITY SCHEME.—Plans for the erection of a power station at Des Moines, Iowa, have been prepared by the Illinois Power & Light Corporation. Work on the first section is to be put in hand at once, and will include the installation of plant with a capacity of 67,000 h.p. When completed, the station will have a capacity of over 200,000 h.p. The estimated cost of the scheme is $16,000,000.—*Power.*

**Weedon.**—ELECTRICITY SUPPLY.—The Northampton Electric Light and Power Co., having been requested by the War Office to supply electricity to the Ordnance Depôt and barracks at Weedon, is to apply to the Electricity Commissioners for powers to supply the whole of Weedon and the surrounding district.

**Whitehaven.**—LOANS SANCTIONED.—The Town Council has received the sanction of the Electricity Commissioners to the borrowing of £2,500 for services and £1,500 for meters.

**Wimborne.**—PROPOSED ELECTRICITY SUPPLY.—The Bournemouth and Poole Electricity Supply Co. has informed the Urban Council and the Cranborne Rural Council that it is applying to the Electricity Commissioners for an Order to supply electricity to Wimborne, Canford, Magna, Kinson, Colehill, Hampreston, Pamphill, and Corfe Mullen. The proposed maximum charge for electricity will be 1s. per kWh.

**Worthing.**—LOAN.—The Corporation is applying to the Electricity Commissioners for sanction to the borrowing of £10,000 for mains and services. Extensions to the power station are being carried out at a cost of £10,000.

# Tramway and Railway Notes.

**Croydon.**—RAILLESS CARS.—A proposal to seek Parliamentary powers to introduce railless cars upon the present Addiscombe tramway route, and extensions, was defeated at a recent town's meeting. It now rests with the Council to decide whether there shall be a poll of the whole borough on the subject.

**London.**—RAILWAY BREAKDOWN.—From early morning until nearly midday on January 10th the service on the Metropolitan Railway between Baker Street and Aldgate was curtailed owing to the failure of the automatic signalling system. The cause was ultimately traced to a defect in a signal cable between Farringdon Street and Aldgate. Delay occurred on the Bakerloo line owing to a defective motor, and a short stoppage occurred between Aldgate East and Mark Lane, in consequence of a wire fusing.

NEW MORDEN LINE.—Work on the construction of the new tube railway to Morden has commenced, and contracts have been placed for the sinking of shafts at points where the future stations are to be built. The new extension will be five miles in length, of which 4¼ miles will be tunnelled.

**Manchester.**—"ONE-MAN" TRAMCAR.—The Corporation is carrying out experiments with a "one-man" single-deck tramcar, on the route between Denton and Haughton Green.

**Sunderland.**—NEW ROUTE.—The Town Council has adopted a scheme of the Tramways Committee for the construction of a single tramway track from the junction of Holmeside and Park Lane, *vid* Derwent Street and Mary Street, to a point near the fountain in Durham Road. The estimated cost is £2,800.

## Telegraph and Telephone Notes.

**Belgium.**—AUTOMATIC TELEPHONY.—The Belgian Postal and Telegraph Administration intends shortly to make first trials of an automatic public telephone system.

**Brazil-Argentina Cables.**—POSTPONED CABLE INAUGURATION.—It is reported from Buenos Ayres that the executive authorities have postponed for one year the time previously fixed for the inauguration of the submarine cable which is to connect various parts of the coast of Brazil with Buenos Ayres.

**Chile.**—PROPOSED RADIO STATION.—Representatives of French and American interests, supported by Chilean financiers, have just established a company with the object of building a big radio telegraph station in Chile able to communicate with Europe.

**Columbia.**—TELEGRAPH SERVICE REORGANISATION.—A Bill has been introduced into the Parliament of the Republic authorising the engagement of foreign experts to undertake the reorganisation of the postal and telegraph services. It is also intended to set up a school of telegraphy for the technical training of the native staffs in telegraphy and radio work.

**Guatemala.**—TELEGRAPH AND TELEPHONE DEVELOPMENT.—During 1922 97 miles of telegraph and 32 miles of telephone line were added to the system in the Republic of Guatemala.

**International Telephone Trust.**—AN AMERICAN PROJECT.—According to the *Financial Times* a group of American financiers has a project in hand for the consolidation of telephone systems throughout the world, and considerable progress has already been made. Overtures have been made to France, Spain, Italy, Belgium and several other countries, and the plans for "The International Telephone Trust" are expected to be further developed at the Inter-American Electrical Conference to be held at Mexico City in March. The moving spirit in this ambitious enterprise is believed to be the International Telephone & Telegraph Co., which is associated with the American Telephone & Telegraph Co., two concerns which already control telephonic communication in the United States, Canada, Cuba, Porto Rico and Uruguay, besides parts of Argentina and Chile. Progress in Europe has been handicapped by the reluctance of the Governments concerned to give up control, but in Spain, Italy, and Germany this difficulty has been overcome and the recent action of the French Government in agreeing to sell its West Indian cable system has aroused hope that something may eventually be accomplished in France. The ultimate ambition of the group is to control not only telephone, but transoceanic communication also by means of high-speed cables and standardisation of apparatus development.

**Mexico.**—NEW TAMPICO TELEPHONE CO.—*Commerce Reports* announces the organisation of the Tampico-Mexico Telephone Co., which plans to begin at once the installation of a local exchange in Tampico with long-distance connections with Victoria and Tamaulipas. Later it expects to extend lines to Monterey and the Texas border. Tampico, with a population of approximately 100,000, has been heretofore without adequate telephone service. Many of the large petroleum companies maintain private telephone lines, which the new company expects to absorb into its new public system.

**Norway.**—ANOTHER ARCTIC RADIO STATION.—In the course of the next few weeks another of Europe's northerly radio stations will be completed at Vardoe, in the extreme north of Norway. It will be of moderate size, but will include radio telephone apparatus. The transmission radius will enable it to maintain communication with Spitzbergen in the north and with the Fauske station in the south. The masts are each 59 metres high. The Vardoe station will assume a position of importance in view of its situation with regard to the trawling fleets engaged in Arctic waters—along the north coast of Norway or in the region of the White Sea. Weather and other reports of usefulness and interest to the fishing fleets will be regularly sent out.—*Reuter* (Bergen).

**North Sea Cables.**—NEW SERVICE.—The Lord Mayor of Hull on January 1st dispatched a telegram of congratulation to the Burgomaster of Copenhagen on the inauguration of direct communication with Denmark, Sweden, Finland, and Russia by the Great Northern Telegraph Co. This was the first cable sent from Hull. The Lord Mayor expressed the opinion that the new service would be of great use to the commercial interests of the port.—*Morning Post.*

**Radio at Sea.**—NEW ADMIRALTY REGULATIONS.—Admiralty Fleet Orders issued on January 4th contain regulations for the use of radiotelegraphy or telephony by foreign warships in British harbours. It is stipulated, among other things, that foreign war vessels lying in a naval port or in any harbour which is close to a naval port shall obtain permission from the senior naval officer at the naval port to use their apparatus, stating the system, wave lengths, and times of transmission proposed. Foreign warships lying in any harbour which is not close to a naval port must conform to certain regulations, which include the following: Transmission on 600 metres is forbidden except for the purpose of making or answering signals of distress; interference with Naval, Army, or Air Force signalling or any fixed shore stations must be avoided and transmission must be discontinued on request from any naval authority, the port authorities, or any fixed shore station.—*Birmingham Post.*

**Salvador.**—TELEGRAPH AND TELEPHONE DEVELOPMENT.—According to a recent return, 26 miles of telegraph lines were added to the State system in the Republic of Salvador during 1922, bringing the total up to 2,420 miles. The number of telephones in use in the Republic increased from 2,696 in 1921 to 2,777 in 1922. The system employed is the Ericsson.

**The Telephone Service.**—LONDON'S AUTOMATIC EXCHANGES.—The decision to discontinue the installation of manually-operated telephone exchanges in the London area has led to large contracts being placed for the manufacture of the necessary equipment and the equipping of the new exchanges will be commenced as soon as the buildings can be built. The system will provide for the needs of over 1,000,000 subscribers connected to more than 100 exchanges. It will not be possible to provide the necessary number of cables by means of ordinary street ducts laid near the surface, and it has been decided that the cables must be housed in special tunnels at a depth below the surface of the roadway. The difficulty of placing conduits under roadways increases, and in order to obviate the necessity for opening up the roads for cable-laying operations use is being made, whenever conditions permit, of a thrust borer, which has been used with success.—*The Times.*

The *Industrial Daily News* learns that the Post Office authorities have decided to put in hand immediately the erection and equipment of the new "Bishopsgate" telephone exchange in Little Pearl Street, E.C.2. A contract for the erection of the buildings has been placed with Messrs. Chessums, Ltd. "Bishopsgate" will be the first automatic exchange in the City.

After the number had been for some time in the region of 399,000, it was announced last week at the Controller's office of the London Telephone Service that there were then 400,077 telephones in the London area.—*The Times.*

**The Telegraph Service.**—LONDON-CHICAGO CIRCUIT.—The Western Union Telegraph Co. announces that direct communication by cable and wire was established on January 7th between London and Chicago. This enables messages to be exchanged between the two cities at a greater speed than formerly, since messages will no longer be subject to delay in New York.

**United States.**—SECRET RADIO COMMUNICATION.—The first public demonstration took place recently in Chicago, says the *Financial Times*, of a new system which, it is claimed, ensures privacy of radio communication. The device is known as the "Dunmore" relay; it transmutes the radio impulses into a specially-devised telegraph code which, when received by the radio set, is passed through the relay, and thence to an ordinary printing ticker. Privacy is secured by placing the sending keyboard in improper relationship with the radio pulsator and by making similar connections at the receiving station only that station can receive intelligible signals.

## Radio Notes.

**Argentina.**——RADIO-BROADCASTING.—The Parliament House of Argentina is connected by wire with the big station at Palermo, whence the speeches of deputies are broadcast by radio telephony over an area of 2,000 kilometres. It is proposed to mount loud speakers on motor-cars to enable wayfarers to enjoy the deputies' oratory.—*Electricité pour Tous.*

**Canada.**—RAILWAY BROADCASTING PROPOSAL.—Mr. W. D. Robb, the vice-president of the Canadian National Railways, announces that he proposes to elaborate a broadcasting system for the benefit of the travelling public on the company's lines. Arrangements are now being made for the establishment of broadcasting stations at Montreal and Ottawa for Eastern and Central Canada and other stations will be installed in Western Canada. Mr. Robb says: "Canadian National Railway trans-continental trains will soon be equipped with receiving sets handled by skilled operators for the pleasure and benefit of travellers, and in our series of hotels there will soon be the most complete radio sets possible." Radio receiving on trains was successfully carried out during Mr. Lloyd George's tour in Canada, when the current news was constantly received on the train journey from Montreal to Winnipeg.—*Reuter* (Montreal).

**Irish Free State.**—RADIO TELEPHONY.—The Postmaster-General of the Irish Free State recently issued a warning that, without a licence granted by him, no one is allowed to install any radio telephone apparatus. A person who establishes a radio station without a licence is liable on summary conviction to a penalty of £10, and on conviction on indictment to a fine of £100, or to imprisonment for twelve months. Licences are granted to experimenters who satisfy the Postmaster-General that they have in view some object of scientific value, or of general public utility, and that they are competent to carry out experiments. Pending the completion of the arrangements for the establishment of a broadcasting station in the Free State no licences for broadcast reception are being issued.

**Radio-Broadcasting.**—LICENSED LISTENERS.—According to Mr. A. R. Burrows, director of programmes for the British Broadcasting Co., Ltd., there are now 600,000 listeners officially licensed by the Post Office, the number having grown from 300,000 since October last.

"CONTROL" OF AERIALS.—A suggestion that the Bournemouth Borough Council should take steps to regulate the size of aerials was considered recently, and instructions—the nature of which was not disclosed—were given to the Town Clerk. The suggestion was made by the Southbourne branch of the National Citizens' Union, which thinks that the residential part of the town is in danger of disfigurement owing to the large number of aerials that have been erected since the Bournemouth broadcasting station was opened.—*Evening News.*

## Contracts Open and Closed.

*(The date given in parentheses at the end of the paragraph indicates the issue of the* ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

### Open.

**Australia.**—SYDNEY.—March 3rd. Harbour Trust Commissioners. Two 3,000-ft. lengths of electric submarine cable.

February 18th. Municipal Council. Distribution transformers, 59 (5,000/415 V) and 35 (10,000/415 V). Messrs. Preece, Cardew & Rider, London.

March 5th. New South Wales Government Railways and Tramways. Ironclad switchgear for Prince Alfred, Meeks Road, and Hurstville sub-stations.*

MELBOURNE.—May 22nd. Commonwealth of Australia. Automatic common battery telephone equipment. Schedule, N.S.W. 74. (See this issue.)

**Belgium.**—January 23rd. Société Nationale des Chemins de fer Vicinaux. Underground cables for the local Brussels-Espinette-Waterloo line.*

February 1st. The municipal authorities of Herck-la-Ville (Province of Limbourg). Establishment of a low-pressure electricity distribution system to serve the little towns of Lummen, Meldert, Loxbergen, Donck, Haelen, Herck-la-Ville, and Zeelhem.

February 23rd. Deputation Permanente de la Province d'Anvers, 3, Rue Saint Bernard, Antwerp. Establishment of an electricity distribution system to serve the Beerse, Herenthals, Gheel, Moll, Arendonck, and Turnhout districts. Particulars, 10 fr., and copies of the plans, 20 fr.

February 26th. Deputation Permanente de la Flandre Occidentale in Bruges. Establishment of an electricity distribution system to serve the Ostend, Nieuport, Coxyde, Furnes, Dixmude, and Moere districts. Particulars, 10 fr., and copies of the drawings, 20 fr., from the Bureaux du Service Provinciale d'Electricité (Bureau No. 80), Bruges.

**Bexley.**—February 7th. Electricity and Tramway Department. Two groups of 700-kVA Scott-connected transformers; one 150-kVA single transformer; two 300-kW rotary converters, complete with transformers and all accessories; e.h.p., h.p. and l.p. switchgear, cables and connections within the station. (See this issue.)

**Bradford.** — January 28th. Tramways Committee. Supply of six railless electric vehicles and spare parts. Mr. R. H. Wilkinson, general manager, 7, Hall Ings, Bradford.

**Carlisle.**—February 15th. Electricity Department. Four water-tube boilers complete with stokers, &c.; electrically-operated overhead turbine-room crane; 6,000-kW turbo-alternator and condensing plant; switchgear. (See this issue.)

**Croydon.**—January 28th. Electricity Committee. 50-ton electric crane; one 10,000-kW turbo alternator. (See this issue.)

**Denmark.**—COPENHAGEN.—February 12th. Lighting Department. Transformer plant.*

February 13th. Turbo-generator plant and accessories.*

**Dublin.**—January 26th. Electricity Department. E.h.p. switchgear and accessories. (January 11th.)

January 25th. 5,000-kW generating set, condensing plant, steam and water piping, &c. (January 11th.)

**Edinburgh.** — January 26th. Corporation. Electric lighting installation at 18 houses at Leith. W. N. Thomson and Co., surveyors, 87, Constitution Street, Leith.

**Egypt.**—CAIRO.—March 1st. The Director-General, Section of Municipalities and Local Commissions, Savoy House, Cairo. Supply and installation of a hydro-electric station, a transmission line and distributing poles in The Fayum.*

March 20th.—Supply and installation of electrical works and system at Benha.

March 27th.—Supply and installation of electrical works and system at Chebin el Kom.

April 3rd.—Supply and installation of electrical works and system at Miniet el Kamh.

April 10th.—Supply and installation of electrical works and system at Beni-Mazar.

**Grimsby.**—February 4th. Electricity Department. E.h.p. switchgear. (January 4th.)

**Ilford.**—January 24th. Electricity Department. 1,900 yd. .5 sq. in. triple concentric l.p. cable. (See this issue.)

**Lancaster.**—The Electricity Department is inviting tenders for e.h.p. switchgear and transformers for the sub-stations.

**Liverpool.**—January 31st. Electricity Department. 12 months' supply of materials, including cables and accessories, meters, electric lamps, sundries, &c. (See this issue.)

**London.**—CAMBERWELL, S.E.—January 28th. Borough Council. Maintenance for 12 months of electric lighting, heating, and power installations, telephones, &c.

Twelve months' or, alternatively, 6 months' supply electric lamps. Specifications from Mr. W. J. Bell, borough engineer, Town Hall, Camberwell, S.E.

LONDON COUNTY COUNCIL.—January 21st. Three 2,000-kW rotary converters, static transformers, and accessories. (January 4th.)

February 11th. H.p. and l.p. switchgear, comprising h.p. switchgear with control panels and d.c. switch panels for 2,000-kW rotary converters. (See this issue.)

BERMONDSEY.—January 24th. Electricity Works. Twelve months' supply of stores, including cable, conduits, meters, lighting and wiring accessories, &c. (January 4th.)

ISLINGTON.—January 24th. Board of Guardians. Installing electric lighting at the relief station, dispensary, &c., at Liverpool Road, Islington. (January 11th.)

WEMBLEY.—January 26th. Department of Overseas Trade. Supply and fixing of armoured sub-main cables in H.M. Government Building at Wembley. Specifications from the Electrical Engineer, Room 517, War Office, Whitehall, S.W.1.

METROPOLITAN ASYLUMS BOARD. January 30th.. Installation of a 144-tube economiser; new continuous drying machine; engineering work for new central boiler house; revising laundry engineering arrangements and installing electric light and power wiring in boiler house and laundry. (January 11th.)

**Manchester.**—February 4th. Electricity Committee. One locomotive jib crane and grab. (See this issue.)

**New Zealand.**—WELLINGTON.—March 5th. Post and Telegraph Department. Supply of screwed bridle rings (Ref. 12913/ED./EC/2).*

TARANAKI.—February 6th. Electric Power Board. Supply of No. 1 pipe line, 3,895 ft. of pipe fittings and accessories; two large sluice valves. (Ref. 12919/ED/EC/2.)*

**Rumania.**—CONSTANTZA.—January 25th. Tenders are invited for a 50-year electric lighting concession; also for the construction of tramways in the city and its outskirts. Particulars, Hotel de Ville, Constantza, Rumania.

**Sheffield.**—February 4th. Tramways and Motor Department. 25 double-deck vestibule tramcar bodies, complete with trucks and electrical equipment. (See this issue.)

**South Africa.**—JOHANNESBURG.—February 28th. Turbo-generator plant and accessories.*

March 8th. Electricity Supply Commission. Tenders for the establishment and working of a proposed undertaking for the supply of electricity to the railways in the neighbourhood of Cape Town. (January 11th.)

March 8th. Electricity Supply Commission. Electrification of South African railways. Plant required in connection with the supply of electricity to the railways in the neighbourhood of Cape Town:—Steel-frame buildings for power station; boiler-house equipment; coal- and ash-handling plant; turbo-alternators; condensing plant; power station switchgear; sub-station switchgear; transformers for step-up sub-station and power station; sub-station equipment; cables. (January 11th.)

March 8th. South African Railways and Harbour Board. Electrification of Cape Town and Simonstown lines, motor bogies and electrical equipment of coaches. (January 11th.)

MAFEKING.—February 29th. Municipal Council. Electricity generating plant.*

**Stoke-on-Trent.**—February 13th. Electricity Department. H.p. single-phase ironclad switchgear, coal bunkers, conveying plant, e.h.p. ironclad switchgear, e.h.p. truck-type sub-station switchgear, and static transformers. (See this issue.)

**Tiverton.**—February 8th. Town Council. Buildings and plant in connection with the installation of an electricity supply in the town:—Power-house buildings; gas engines and generators; main l.p. switchboard; balancer-booster set; battery; hand-operated traveller crane; mains—underground and overhead. (See this issue.)

***Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.**

## Closed.

**Barrow.**—Town Council. Accepted:—
Cable for the High Level Bridge feeder (£929).—British Insulated and Helsby Cables, Ltd.

**Belgium.**—Belgian, German, Swiss, and British (the British Insulated & Helsby Cables, Ltd.) firms submitted tenders last week to the municipal authorities of Romsée for the supply of 385 electricity meters. The lowest offer was that of the Société Industrielle de Matériel Electrique, of Brussels.

Swiss and Dutch firms, in addition to home concerns, competed for the supply of a quantity of electricity meters to the municipal authorities of Ixelles, Brussels. The lowest offer was that of the Isaria Co., of Amsterdam.

**Canterbury.**—Board of Guardians. Accepted:—
Electric lighting installation for outdoor shelters.—Philpot & Son.

**Gillingham (Kent).**—Town Council. Accepted:—
Electrically-driven centrifugal pump (£73).—Messrs. Gwynnes, Ltd.
10-b.h.p., 3-phase, 400-volt motor.—Metropolitan-Vickers Electrical Co., Ltd.

**Japan.**—Messrs. Vickers, Ltd., of Barrow-in-Furness, recently received an order for Japanese owners for two marine heavy oil engines of 600 b.h.p., to be repeats of the engine recently delivered to the order of their associates, Messrs. Mitsubishi Shoji Kaisha, Ltd.

**Lancaster.**—Town Council. Accepted:—
E.h.p. cable in connection with the improved distribution system.—British Insulated & Helsby Cables, Ltd.

**London.**—ST. MARYLEBONE.—Electricity Supply Committee. Recommended:—
Installation of wiring for electricity to the staircases, and of the conduit system in tenements at Wharncliffe Gardens under the Council's free-wiring scheme (£2,473).—Messrs. Symper & Evershed.

STOKE NEWINGTON.—Electric Lighting Committee. Recommended:—
Two motor-converters (£8,470).—Bruce Peebles & Co., Ltd.
Switchgear (£2,339).—General Electric Co., Ltd.
Feeder mains (£8,503).—W. T. Henley's Telegraph Works Co., Ltd.

**Manchester.**—Gas Committee. Accepted:—
Electric locomotive.—West's Gas Improvement Co., Ltd.

Markets Committee. Accepted:—
Electrical plant at the Elm Street cold stores.—Harland Engineering Co., Ltd.; sub-contractors: Motor.—Lancashire Dynamo and Motor Co., Ltd. Isolating box.—Dorman, Smith, Ltd. Oil switches.—Ferguson, Pailin, Ltd. Starter.—Allen, West & Co., Ltd. Cables.—Callender's, Ltd., or Macintosh, Ltd. Crank shaft.—G. Luxon, Ltd. Gearing.—Power Plant Co., Ltd.

Tramways Committee. Accepted:—
Tramcar motors.—General Electric Co., Ltd.; British Thomson-Houston Co., Ltd.

Waterworks Committee. Accepted:—
Electrification of steam-driven plant, Whitworth Street West.—Electric Construction Co., Ltd.

**Runcorn.**—Town Council. Accepted:—
Supply of electric cable to the new Corporation motor garage, and the supply and erection of electric lighting fixtures inside the garage.—Mersey Power Co.

**Sheffield.**—Tramways Committee. Accepted:—
500 tramcar tires at 61s. 9d. each.—Cammell, Laird & Co., Ltd.

**Stafford.**—Electricity Committee. Accepted:—
3,000-kW turbo-generator and condensing plant (£14,939).—English Electric Co., Ltd.
Boiler (£4,100).—Stirling Boiler Co., Ltd.

**Turton (near Bolton).** — Urban District Council. Accepted:—
Supply and laying of cable to supply electricity to Quarlton Vale Works.—British Insulated & Helsby Cables, Ltd.

**Wellingborough.**—Board of Guardians. Accepted:—
Installing electric lighting at the Institution (£141).—Bedford Electricity Co. The highest tender was £447.

**Yorkshire.**—Messrs. Chas. Bell, Ltd., of Bradford, have received the following contracts:—
Electric light installation at the workhouse and hospital, &c., at Otley, for the Wharfdale Guardians; motor-driven siren for the Fire Brigade Committee, Otley Urban District Council; two electrically-driven goods lifts for Lister & Co., Ltd., Manningham Mills, Bradford; and alterations to goods lifts at new premises for *Yorkshire Observer*, Bradford.

## The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names of makers or suppliers of:—

Electric iron stamped L.M.P. in a diamond.
Heating element stamped B.E.A.G.

## Forthcoming Events.

**Royal Institution of Great Britain.**—Friday, January 18th. At 21, Albemarle Street, W. At 9 p.m. Lecture on "The Scientific Works of Prof. Sir Jas. Dewar, F.R.S.," by Prof. H. E. Armstrong, F.R.S.

**North-East Coast Institution of Engineers and Shipbuilders.**—Friday, January 18th. At the Literary and Philosophical Society, Newcastle-upon-Tyne. Paper on "The Influence of Type of Propelling Machinery on the Running Costs of Ships," by Mr. W. G. A. Perring.

**Salford Technical and Engineering Association.**—Saturday, January 19th. At the Royal Technical College. At 7 p.m. Presidential address by Mr. J. Morris. Musical evening.

**Institution of Electrical Engineers.**—INFORMAL MEETING.—Monday, January 21st. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on "Broadcasting," to be opened by Mr. E. H. Shaughnessey.

**(North-Midland Centre).**—Tuesday, January 22nd. At the Hotel Metropole, Leeds. At 7 p.m. Lecture on "Railway Electrification in Foreign Countries," by Dr. S. P. Smith.

**(Mersey and North Wales, Liverpool, Centre).**—Friday, January 25th. At the University Club, Mount Pleasant, Liverpool. At 7 p.m. Annual dinner.

**(Western Centre).**—Monday, January 21st. At the South Wales Institute of Engineers, Cardiff. At 6 p.m. Address by the President, Dr. A. Russell.

**Illuminating Engineering Society.**—Tuesday, January 22nd. At the Royal Society of Arts, John Street, Adelphi, W.C. At 8 p.m. Discussion on "Co-ordination of Research in Illuminating Engineering, and Some Practical Applications," to be opened by Mr. J. S. Dow.

**Physical Society of London.**—Friday, January 25th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary scientific meeting.

## Notes.

**The Westminster Salvage Plant.**—In the article upon the above subject in our last issue we stated that the whole of the electrical equipment was supplied by the General Electric Co., Ltd. This requires qualification, as the magnetic separator mentioned was supplied through the Coppée Co. (Great Britain), Ltd., by the Rapid Magnetting Machine Co., Ltd. The last-named company has recently supplied, through Messrs. Heenan & Froude, Ltd., a battery of three separators for another salvage plant—that of the Birmingham Corporation.

**Diesel-Electric Ships.**—According to the *Motor Ship*, the following Diesel-electrically-driven ships are amongst the motor vessels now on order: For the U.S. Army Engineer Department the Sun Dry Dock & S.B. Co. is building the *A. Mackenzie*, *W. L. Marshall*, *Dan C. Kingman*, and *Wm. T. Rossal*, each 254 ft. long, with a beam of 46 ft. and a tonnage of 2,000. Each will be equipped with three 3,000-b.h.p., six-cylinder McIntosh & Seymour engines, to give a speed of 10½ knots.

Messrs. Cammell, Laird & Co. are building two additional vessels for the United Fruit Co., the *La Marea* and *La Perla*, each 325 ft. long, with a 48-ft. beam and a tonnage of 5,000; the four 250-r.p.m., four-cylinder, 3,300-b.h.p. engines supply power to one 2,500-b.h.p., 90-r.p.m. electric motor.

**Lost and Found.**—MESSRS. SIMPLEX CONDUITS, LTD., state that a bunch of keys, with a "Simplex" metal tablet attached, was recently found in Adderley Road, Birmingham, and is now in their possession. As it is very highly probable that the owner is an electrical engineer, and as their efforts to trace him have so far failed, they hope that this notice will reach him.

**Appointments Vacant.**—Plumber-jointer, second installation assistant, and assistant draughtsman, for Newport Corporation Electricity Department; engineering assistant for the Newcastle and District Electric Lighting Co., Ltd.; technical assistant (£140+bonus) for H.M. Signal School, Bournemouth; assistant meter superintendent (£305). (See our advertisement pages to-day.)

**Parliamentary Notes.**—Parliament was formally opened by the King on Tuesday, January 15th.

The Speech from the Throne stated that His Majesty welcomed the opportunity that would be afforded by the British Empire Exhibition to increase the knowledge of the varied resources of the Empire and to stimulate inter-Imperial trade. While the Cabinet regretted that their proposals to remedy unemployment had been rejected by the country, the assent of the House would be invited to an extension and amendment of the Trade Facilities and Export Credit Schemes, to the proposal of the Imperial Economic Conference for expediting and assisting the execution of certain public enterprises throughout the Empire by the grant of financial aid from public funds, and to an extension of the contributions towards the cost of public utility works, whether undertaken by local authorities or promoted by statutory and private corporations. Hon. members would also be asked to assist in providing work in the shipbuilding industry by the immediate construction of cruisers and auxiliary craft in anticipation of the naval programme. Bills would be introduced to amend the Factory and Workshops Act.

**Service Note.**—NEW SIGNAL COURSE SYLLABUS.—A new syllabus for the advanced course in signalling is published in Fleet Orders. The course is held at the Royal Naval College, Greenwich.—*The Times*.

**Destruction of Clacton Power Station.**—Since the brief note in our last issue on the destruction of the Clacton municipal power station by fire on January 4th, we have received further information and photographs from a local source. The station contained three Diesel engine sets, and the installation of a fourth, of 750-h.p. capacity, had been decided upon. As previously stated, the fire was due to the overflow from an oil tank being ignited by a gas jet which was being used to facilitate the pumping of fuel oil into the

FIG. 1.—INTERIOR OF THE DESTROYED STATION.

storage tanks. The efforts of the fire brigade had to be devoted to preventing the fire from reaching two nearby gasholders, and the station was completely gutted in an hour and a-half. As will be seen from fig. 1, the engines remained in position. The second illustration (fig. 2) shows the building in flames.

As we go to press we are glad to learn from the electrical

FIG. 2.—THE FIRE IN PROGRESS.

engineer, Mr. George Broadhurst, A.M.I.E.E., that the supply was restored on Sunday evening at 5.55 p.m. Two of the generating sets are in commission, and the extent of the damage is not nearly so great as the published reports suggested.

**Financial Assistance to Public Utility Companies.**—The Unemployment Grants Committee has issued the following notice under date January 14th:—Certain modifications have been made in the terms on which State assistance may be granted by the Unemployment Grants Committee to public utility companies putting in hand works which would not at present be undertaken but for the need for relieving unemployment. The terms of assistance were published in full in the public Press in October last. The principal alteration is in Clause (5), which now reads as follows:—

(5) Assistance will be limited to a maximum of 50 per cent. of interest at an approved rate on the expenditure, as and when incurred, whether out of capital raised for the purpose or out of existing funds or out of current revenue. Grant will be made for a period of years which will be dependent mainly on the extent to which the work is being accelerated, and the date at which the works when completed are likely to be reasonably remunerative.

In cases where the period of assistance does not exceed seven years, the Committee may at its discretion commute, if so desired, the annual interest payments by a single lump sum grant representing the present value of the whole of the interest payments. It has been arranged with the banks that the regulations and requirements under which assistance may be obtained shall be available at their different branches.

**British Electrical and Allied Industries Research Association.**—On Friday last, in connection with the annual meeting of the Association, a luncheon was held at the Connaught Rooms, London, Mr. C. H. Wordingham, C.B.E., the president, being in the chair. Extending a cordial welcome to the guests, Mr. Wordingham said the Association had done a great deal of fundamental work, especially in connection with the study of insulating materials, with a view to improving their quality and drawing up specifications. Very important work had been done on control gear and switching, and the report on the heating of buried cables would result in great economies. Whilst much of its work had been published, in some cases the results were reserved for the use of the members who had paid for the work. Thanks were due to those who had served on committees, especially the chairman, and to the investigators, who in many cases gave their services. The Association was also particularly fortunate in its staff, at the head of which Mr. E. B. Wedmore showed, in addition to skilled experience, a genius for organisation, and kept in close touch with the whole of the work in progress. The only limit to the work of the Association was that imposed by the funds available. All Government assistance was supposed to stop at the end of five years (1¼ years from now), but he was confident that the Government would recognise that the conditions had been very different from those anticipated, and would extend the period. The institution of a class of "associate members," such as supply undertakings, had met with a good response; those undertakings were amongst the first to benefit by the work of the Association, and could legitimately be asked to contribute to the funds. He looked also to the Electricity Commissioners for help when their initial expenses had been paid off. The main source of funds was the B.E.A.M.A., which provided pound for pound with the Government; the Institution of Electrical Engineers also supported the Association. The splendid work of Sir Richard Glazebrook, the president-designate, in developing the National Physical Laboratory, was well known to them. Mr. Wordingham concluded by expressing his appreciation of the honour done him in electing him as the first president of the Association.

Sir Richard Glazebrook, in a short address, showed that the interdependence of science and engineering was recognised 30 years ago, but little was done here until the N.P.L. was started, though the Germans 50 years ago used a large portion of the funds exacted from the French to establish the Reichsanstalt and various technical schools and colleges. The outbreak of war in 1914 had taught the lesson which led to the establishment of the "million fund" and other endeavours to connect science and industry. This country had led the world in the past because of the great start that it had owing to the possession of coal and iron, and to the invention of the steam engine and locomotive, but Germany and the United States had founded research institutions to make up for their handicap. No industry was more dependent on science than the electrical industry, and its enormous growth was due to recognition of that fact. Let them not look too narrowly at the "use" of the results obtained by research—discoveries made for the love of discovery had become the foundations of great industries. Valuable results had already been obtained by the Association, in spite of the difficulties of the times.

Mr. E. B. Vignoles, chairman of the Council, expressed thanks to Sir Richard for his stimulating address, and to Mr. Wordingham for his unsparing efforts during the past year.

**Pulverised Fuel.**—In a letter which he has circulated to the Press, Mr. D. Brownlie writes, with reference to his paper "Pulverised Fuel and Efficient Steam Generation," that a statement which has been circulated that in this paper he has compared the regular running figures of Dalmarnock Station, Glasgow (mechanical stoking) with the short test figures only of the Lakeside Station, Milwaukee (pulverised coal), is "the grossest possible mis-statement."

He says: "The very fact that complete and continuous records for month after month, including of course all standby, banking, and blow-down losses, have been taken with the Lopulco pulverised-fuel plant at Lakeside, is the reason why the paper has been written, and the matter is explained very clearly in the paper itself."

In addition to the figures for continuous running, he has included the results of a number of day tests at Lakeside. On one occasion 89.1 per cent. efficiency was obtained, and recently he has been informed that 91.3 per cent. has been obtained on one test. In the comparison he assumed 86 per cent. for pulverised coal, the continuous figures, since in the more recent stations the guarantee figures alone are as high as 88 per cent.

As regards Dalmarnock, he gave the figures for 52 consecutive weeks, showing 76.6 per cent. boiler plant efficiency, as well as the results of a typical short test (one day, September 21st, 1923), the efficiency figures being 78.4 per cent., and the results of two very short snap tests of 6 hours and 3 hours, giving 81.92 per cent. and 83.56 per cent. efficiency respectively.

In order, however, to give every possible advantage to mechanical stoking, Mr. Brownlie assumed that Dalmarnock might be run at 81¼ per cent., although, he says, "there is not a mechanical stoker station on earth that has ever run continuously at this figure." He asks those interested, therefore, to read the paper themselves, and declares that "the progress of pulverised fuel is not going to be delayed by misrepresentations of this character."

**Accident.**—Last week David Lindsay, of Belfast, was admitted to hospital suffering from severe burns to his head and arms received whilst he was at work at the East Bridge Street power station, Belfast. Lindsay was engaged upon repair work near one of the generators, and was using a portable electric lamp.

## Institution Notes.

**Institution of Electrical Engineers.**—INFORMAL MEETING.—At the meeting of the Informal Section on Monday, January 7th, Mr. H. M. Barlow was in the chair when Mr. J. W. Beauchamp opened a discussion on "Troubles experienced with Domestic Appliances." The opener first made a gentle protest at having been allotted such a subject when he spent so much of his time in assuring people that there were no troubles. He then reviewed the varieties and types of apparatus in use, and showed that such little troubles as were met with were easily curable—some of them arising from minor oversights of design and assembly that were rapidly being eliminated, and most of them from unsuitable application or wrong handling by the user. Here Mr. Beauchamp got on his favourite theme of urging the importance of ready and expert service by the industry's representatives, either the supply authority, the contractor, or the manufacturer. The output of appliances was very rapidly multiplying, and with quantity production lower costs would come. He appealed to the members to let him have their complaints and objections and he would see that they were passed on to the right[illegible] parents.

The large meeting kept the interest going and produced a very useful debate. Mr. F. Selley told of having over 3,000 cookers installed in St. Marylebone, with hardly any trouble. Mr. E. E. Sharp criticised the design of kettles, and asked for a safety device to prevent them burning dry. Information was given that there was a connection obtainable that broke circuit at this stage. Another interesting point brought out was that wall-plugs on a skirting board often had holes right through the base into the current of damp air behind. Through these holes the draught carried the damp on to the fibre plate of the plug top, and short circuits had arisen at this point. Messrs. D. Betts, A. W. Blake, C. E. Charman, W. R. Fanghanel, R. Grierson, A. F. Harmer, E. W. Lovell, F. J. E. Nesbitt, N. Prentice, M. Pulvermacher, and W. L. Wreford also contributed to the discussion, which Mr. Beauchamp reviewed and concluded.

EAST MIDLAND SUB-CENTRE.—Mr. E. G. Phillips, of Nottingham, presided over a meeting of the East Midland Sub-Centre of the Institution at Loughborough on January 8th, when Mr. A. Brookes, M.Eng. (of Messrs. Ericsson), prefaced an interesting address on "Telephone Intercommunication" by the assertion that "civilisation advances by means of its communications." After a brief reference to the rapid advance of radio telegraphy, Mr. Brookes showed a number of slides of several types of automatic telephones up to 30 lines, used for internal communication in business houses, the best of which were proof against "listening in." Slides were shown of various types of switchboard, including desk and wall patterns, one of the most popular being the key pattern cordless switchboard, which worked on the common battery principle with or without facilities for interconnecting with a main or city exchange, and also examples of branch exchanges with 20,000 subscribers. A Toroidal repeater system demonstration board afforded great interest.

The lecturer dealt at length with the working and limitations of the multiple switchboard system, and compared Swedish and English methods. In the former country much smaller jacks were used, and more subscribers could be attended to by one operator. To obviate the embarrassment of a greater number of coils, frequently in Sweden the main switchboard would be built up on a false floor, with openings to let the coils hang through. In England the running expenses of an exchange of over 25,000 subscribers increased out of all proportion to the increase of membership, chiefly owing to the increased amount of cable used to ensure that every operator knew when any number was engaged. From statistics thrown on the screen the following facts were ascertained:—

A 5,000 subscribers' board would be divided into 17 sections; there would be 530,000 soldered connections, and the amount of cable used in the exchange building itself would be 3,000 miles.

With a 20,000 subscribers' board, divided into 67 sections, there would be over 6,000,000 soldered connections and the length of cable used in the exchange building itself would be over 20,000 miles; that was just over one mile per subscriber, as compared with 0.6 mile per subscriber on the smaller board.

The complication of the multiple switchboard system necessitated traffic distribution schemes. Automatically a rotary selector put calls through to a disengaged operator. Mr. Brookes dealt with automatic exchanges with special reference to the working of an Ericsson line finder of ingenious principle, which he stated later in reply to a question of Mr. I'Anson was not proving itself too expensive in upkeep to justify its existence at Stockholm. He stated that Swedish engineers asserted the possibility of setting up an exchange which dealt automatically with as many as six and a half million subscribers.

## Our Personal Column.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.*

The staff and employés of the Bridlington Corporation electricity department presented Mr. W. H. STEEL-MITCHELL with a leather attaché case on his leaving to take up a new appointment with the Yorkshire Electric Power Co. The presentation was made by Capt. A. J. Beckett, borough electrical engineer.

At the meeting of the Manchester City Council, last week, all salary advances proposed by the Establishment Committee were "referred back" until the March meeting. According to the *Daily Dispatch*, an amendment referring back indefinitely the proposed alteration in the position of Mr. H. MATTINSON, general manager of the tramways, was carried by 50 to 28. It was intended that Mr. Mattinson should be appointed general manager and chief engineer at a salary of £1,700 (an increase of £300), rising to £2,000 by increments of £100. Rearrangements of staffs in the tramway and electricity departments were agreed to.

The directors and employés of David Colville & Sons, Ltd., Motherwell, have presented valuable gifts to Mr. J. J. INGLIS, chief electrical engineer of the great steel-making plant, on the occasion of his leaving, after 20 years' association with the firm. The gifts were handed over by Mr. G. P. West, general works manager, at a gathering presided over by Mr. John Craig, C.B.E., chairman of the company, who paid a high tribute to Mr. Inglis's professional work and worth.

Mr. R. CLEGG, of the Burnley Town Clerk's Department, has been appointed temporary clerk to the Mid-Lancashire Electricity District Interim Advisory Board.

Three members of the Mechanical and Electricity Department of the Norwegian State Railways arrived in Liverpool on January 12th by the liner *Montclare*. They had travelled over 16,000 miles, visiting different parts of Great Britain, Canada, and the United States to study railway systems and the electrification of railroad systems.

The Birkenhead Electricity Committee has decided to again submit to the Town Council a proposal to increase the salary of the Borough Engineer from £600 per annum, with bonus, to £825 per annum, without bonus, as from December 1st, 1923. The Finance Sub-committee has approved of the proposal, which was conditionally withdrawn at the meeting of the Corporation on December 12th.

According to Press reports, the employés of the Stanton Ironworks Co. have presented the managing director, Mr. E. J. FOX, with a gold cigarette case in recognition of his efforts to bridge the gulf between capital and labour.

A correspondent says that Mr. J. S. MILNE, chief engineer of the Todd Shipyard Corporation, in company with Mr. WILLIAM H. SMITH, superintendent of the Corporation's Tebo works at Brooklyn, recently landed at Plymouth on a business trip in Europe, one of their objects being to arrange for the manufacture and sale of the Todd electric welder in this country.

**Obituary.**—MR. S. SMITH.—The death took place suddenly on January 5th, of Mr. Samuel Smith, partner in the firm of Messrs. J. Smith & Son, electrical engineers, of North Road, Brighton. He was 47 years of age.

Mr. J. F. BUCKLEY.—The death has occurred, after an operation, of Mr. James Fothergill Buckley, who was electrical engineer at the Round Oak Iron Works of the Earl of Dudley. He was 47 years of age.

Mr. J. D. CAIRD.—The death is reported at Bournemouth of Mr. James D. Caird, traffic superintendent of the Halifax Corporation tramways from 1908 to 1921, when he resigned the appointment for health reasons.

Mr. G. CLAPPERTON.—An Exchange Telegraph message from New York announces the death of Mr. George Clapperton, vice-president of the Commercial Cable Co. He was born in 1854 in Shropshire.

**Will.**—The late Mr. J. A. L. DEARLOVE left £83,539 gross personalty. He left £50 each to the Benevolent Funds of the I.E.E. and the Institution of Civil Engineers.

## New Companies Registered.

**Clowne Electric Supply Co., Ltd.** (194,933).—Private company. Registered January 7th. Capital, £3,000 in £1 shares. To carry on at Clowne, Derbyshire, and elsewhere the business of an electric lighting and supply company, &c. The first directors are:—W. H. Gregory, Holmhurst, North Road, Clowne; J. Robotham, 38, Mill Street, Clowne; F. J. Hutchings, Westfield Farm, Barlborough, Chesterfield; J. T. Hill, Lime Tree Villas, Neale Street, Clowne; G. H. Henshaw, 18, Mitchell Street, Clowne. Qualification, £100 shares. Secretary: J. Robotham. Registered office: 38, Mill Street, Clowne, Chesterfield.

**Carrick Wedderspoon, Ltd.** (2,287F).—Particulars were filed on January 4th, pursuant to Section 274 of the Companies (Consolidation) Act. The capital is £30,000 in £1 shares. The company was incorporated in New Zealand on February 22nd, 1923, to acquire the business carried on at Christchurch and elsewhere in New Zealand and abroad as Carrick Wedderspoon & Co., and to carry on the business of electrical and mechanical engineers, merchants, suppliers of electricity, &c. The British address is at 25, Victoria Street, Westminster, S.W.1, where J. H. Wild is authorised to accept service of process and notices on behalf of the company. The directors at the date of registration were W. C. Wedderspoon and Mrs. J. C. Wedderspoon (life director), both of Christchurch.

**Universal Ledger Supplies, Ltd.** (194,864).—Private company. Registered January 3rd. Capital, £12,500 in £1 shares (6,500 10 per cent. participating preference). To acquire the businesses of "Radio Gramophones, Ltd.," radio engineers, "The New Electra Sign Co., Ltd.," electric sign manufacturers, and "James' Looped Thong Ledger Co.," loose leaf ledger manufacturers. The joint managing directors are:—J. H. Slingsby, Middlemarch, Nuneaton; F. James, Church House, Welford-on-Avon. Qualification, 100 shares. Registered office: 30-32, Bolsover Street, W.1.

## Official Returns of Electrical Companies.

**Electricity Company of Macclesfield, Ltd.**—Particulars filed of £30,000 debentures authorised December 14th, 1923, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

**General Cable Manufacturing Co., Ltd.**—Particulars filed of £5,000 debentures authorised January 2nd, 1924, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

**Halesowen Lighting and Traction Co., Ltd.**—Debenture dated December 18th, 1923, to secure £15,500, charged on the company's undertaking and property, present and future, including uncalled capital (if any). Holders: Shropshire, Worcestershire and Staffordshire Electric Power Co., 88, Kingsway, W.C.

**Yorkshire Cable Co., Ltd.**—R. H. B. Heap, of 32, Market Street, Bradford, was appointed receiver and manager on December 31st, 1923, under powers contained in debenture dated October 12th, 1921.

**Tofield and Robinson, Ltd.**—A. C. Ridgway, of Exchange Buildings, New Street, Birmingham, ceased to act as receiver or manager on January 4th, 1924.

**Electric Holdings, Ltd.**—Satisfaction to the extent of £1,234,992 (being total amount issued and outstanding) on December 31st, 1923, of prior lien stock secured by trust deed dated August 22nd, 1917, securing £1,243,300.

**Brown, Boveri & Co., Ltd.** (89,167).—Return dated October 31st, 1923. Capital, £50,000 in £5 shares. All shares taken up. £3 10s. per share called up on 8,500 shares. £21,250 paid. £7,500 considered as paid on 1,500 shares. Mortgages and charges, nil.

**Mawdsley's, Ltd.** (91,783).—Return dated December 24th, 1923. Capital, £20,000 in £1 shares. 18,937 shares taken up. £6,937 paid. £12,000 considered as paid. Mortgages and charges, £6,300.

**W. Sanders & Co. (1915), Ltd.** (142,057).—Return dated December 31st, 1922 (filed September 18th, 1923). Capital, £2,000 in £1 shares. 1,905 shares taken up. £5 paid. £1,000 considered as paid. Mortgages and charges, £1,000.

**Southern Electric Free Wiring Co., Ltd.** (64,550).—Return dated November 7th, 1923. Capital, £5,000 in £1 shares. 1,510 shares taken up. £1,510 paid. Mortgages and charges, nil.

**Eastern Extension, Australasia & China Telegraph Co., Ltd.** (7,224).—Return dated August 8th, 1923. Capital, £4,000,000 in £10 shares. All shares taken up. £4,000,000 paid. Mortgages and charges, £72,400.

## City Notes.

**Telephone Manufacturing Co., Ltd.**

The third annual general meeting was held, under the chairmanship of Viscount Chetwynd, C.H., on January 9th. In presenting the report and accounts, which were reviewed in our issue of December 21st (p. 947), the chairman stated that the remarkable increase in gross profit was the outcome of the policy of the board in developing a direct trading business as distinct from the "leasing business" carried out through the installation companies, although this had been offset to a large extent by the increased "running" expenses. The accounts did not embody the results of installation companies abroad, but to meet possible losses through depreciated currencies a sum of £17,500 was being held in reserve. The depression of trade had continued during the year under review, and in certain directions conditions became worse. The "boom" in the sale of radio apparatus, which followed upon the commencement of activities by the British Broadcasting Company, had been stifled by the delay in settling the licence question, and in the lull which followed foreign material and apparatus secured a firm footing. The company, however, secured a fair share in whatever business was available. Viscount Chetwynd congratulated the Postmaster-General upon his very fair solution of the matter. The Brussels business continued to expand, and business in Australia was remarkably good. The company in Madrid was progressing, but that in Paris was not doing too well. The directors looked forward to the further development of the "Laryngophone" in its application to ships. Regarding the future, all that he could say was that until foreign exchanges righted themselves no general improvement in the trade of the country could be expected. Without a healthy export trade the country could not be prosperous, and, moreover, taxation must be reduced.

Mr. F. T. Jackson, the managing director, then addressed the meeting, and explained why costs had been increased. It was the development of direct trading, but this was proving to be very remunerative, and the company had a selling organisation which could deal with a much larger turnover with little increase in expenses. The results secured had justified the additional expense, and sales were increasing. The working expenses of the installation companies had been considerably reduced, although rentals were higher than in any previous period. It had been considered prudent to use the profits gained by the Brussels business in development owing to the state of the exchange. The first report of the Madrid Company was expected to be satisfactory.

A good steady business in radio-telephone apparatus was being carried on, and the "Trumusic" loud speaker was especially successful; a growing export business in this particular appliance was being developed. To his mind the "Laryngophone" was the ship's telephone of the future, and it was already recognised as such by some of the leading shipping companies.

At a subsequent extra-ordinary meeting the directors were empowered to raise or borrow money up to an amount not exceeding the authorised capital of the company, and to secure this in such manner as they might think fit.

**French Companies.**

The report of the *Société Electro-Metallurgique de Dives* for the year ended June 30th last shows a net profit of 4,585,490 fr., as compared with only 2,765,797 fr. in the preceding twelve months.

The balance sheet of the *Société Industrielle des Téléphones*, of Paris, for the year ended June 30th last shows a net profit of 7,718,365 fr., which is being distributed as follows: depreciation, 2,250,000 fr.; bonuses to staff and officers, 678,145 fr.; suspense account, 1,750,000 fr.; and dividend of 50 fr. per share, 3,000,000 fr.; leaving 40,219 fr. to be carried forward.

**Montreal Tramways, Light, and Power Co.**—A Montreal dispatch to the *Financial Times* stated that on January 7th a dramatic *denouement* came to the fierce fight to unseat the directorate of this company. It was announced that Mr. E. A. Robert had resigned the presidency and would be succeeded by Mr. W. C. Finlay, with Mr. Alcide R. Beauvais as vice-president; also that the following new directors would be appointed:—Mr. F. B. McCurdy, Dr. Noel Fournier, and Mr. Alcide Beauvais.

**Stock Exchange Notices.**—Dealings in the following have been specially allowed by the Exchange Committee under Rule 159:—

Hendon Electric Supply Co.—60,000 ordinary shares of £1 each, fully paid, Nos. 1 to 60,000 and 100,00 six per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 100,000.

Application has been made to the Committee to allow the following to be officially quoted:—

Enfield Cable Works.—200,000 seven and a-half per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 200,000.

**Italian Company.**—The Società Mediterranea di Elettricità (Rome), at an extraordinary meeting has decided to raise its capital from 18,000,000 to 25,000,000 lire. The Società Agordina per Elettricità (Agordo) has likewise dicided to raise its capital from 198,000 to 297,000 lire.

**Charles Churchill & Co., Ltd.**—The *Financial Times* states that the accounts to March 31st, 1923, show a loss of £27,149, and after transferring £9,950 from general reserve the credit balance brought forward was reduced to £8,144.

**United River Plate Telephone Co., Ltd.**—At an extraordinary general meeting on January 15th, the directors were accorded powers to raise the capital of the company to £3,500,000 by the issue of 100,000 new £5 shares.

**Siemens Bros. & Co., Ltd.**—Dividend on 10 per cent. cumulative preference shares for half-year ended December 31st, payable January 25th.

**Bell Telephone Co. of Canada.**—Quarterly dividend of two per cent.

**Western Union Telegraph Co.**—Dividend of 1¾ per cent. for the quarter.

**Kaministiquia Power Co.**—Dividend of $2 per share on the common shares for the quarter ended January, 1924.

**Electrical Utilities Corporation.**—Dividend of 1¼ per cent. on the preferred stock for the quarter to December 31st, 1923.

## Stocks and Shares.

MONDAY EVENING.

WAITING for the start of a new session of Parliament that is likely to prove momentous in the history of finance as well as in that of the nation, Stock Exchange markets cannot be expected to show any degree of vitality. They stand upon the tiptoe of an anticipation which is tempered with anxiety. Prices in most parts of the Stock Exchange have again given way during the past week. As noted previously, it is not so much that people are selling their stocks and shares which causes the dullness, as the fact that money which would be ordinarily employed at this season of the year is restrained from coming into security-channels by reason of the political uncertainty.

Industrials tend to lower levels, and there is no spring amongst gilt-edged stocks. With depression prevailing in the War Loan, Conversion and other British Government issues, the natural disposition of prior-charge issues is for them to be heavy also. A bright exception of strength is provided in our lists this week by Brazilian Tractions, which have gone up four points owing to the remarkable recovery that has occurred in the milreis. This is one redeeming feature in the five groups of securities with which we deal.

Another is provided by the strength of British Columbia Electric Railway stocks, the prices of which, now ex dividend, are again better, owing to the recently increased dividends on the Preferred and Deferred stocks. A gain of 4 in Edison Swan debenture shows that home industrials are not uniformly flat.

Electricity supply shares lean to the lower side, in consequence of the cessation of that support which was so noticeable during 1923. The proposal to nationalise the railways, which is a plank of the Labour Party, hints at a possibility that similar treatment may be proposed in connection with utility undertakings. This impression is extremely vague and nebulous; so much so, in fact, that prices have not gone back to any marked extent. It comes, however, just at the time when the electricity supply companies are on what should be the eve of one of the greatest strides made by them during their 35 years of existence. Some slight disagreement has arisen between the companies themselves with regard to the lines upon which Parliament shall be approached with a view to carrying out the franchise that will extend the lives of the undertakings for another forty years from 1931. Differences of opinion have taken definite shape, confirming the statements made here some weeks ago, but these differences are not of sufficient importance to suggest that they will fail to be readily composed. Having regard to the political outlook, it may be safely assumed that every effort will be made to harmonise the present conflict of opinion as to the best way for legislating with regard to the future.

In the price-list, minor falls have occurred in Brompton ordinary, City of London, County, Charing Cross, Edmundsons, Londons, Urbans, and Westminsters, while a few of the Preferences are also easier. These declines are due to the unsettled conditions prevailing in stock markets as a whole, and would have occurred in any case. They cannot be debited to any fear lest the companies shall find themselves unable to agree upon a unanimous plan for presenting their case to Parliament in the new session.

Home Railway stocks are lower, by reason of the trouble that has arisen in connection with the engine-drivers' pay and the fear lest there may be a lightning strike. The Underground group is not affected by the labour trouble, but it shows a sentimental effect, and Districts dropped to 53, the Underground £10 shares to 2¼, and the Income bonds to par. Metropolitan Consolidated remains firm at 72, having been up to 73. The Undergrounds companies are expected to benefit very substantially from the British Empire Exhibition, remarkable interest in which has been aroused outside this country as well as in Great Britain itself. Preparations are being made for Colonial representation at this Exhibition on a scale not hitherto attempted, and it may be asserted without hesitation that the Exhibition will attract a vast concourse of visitors, from whom the railway companies will take profitable toll.

Cable stocks and shares continue to droop, although Westerns, which fell 7s. 6d. last week, have recovered a third of the loss. Eastern Ordinary at 160 ex dividend begin to look cheap, and Eastern Extensions at 15¾ are equivalent, in stock, to 157½. Globe 6 per cent. preference have fallen back to 10¼.

One of the political rumours current during the past few days has been that the Labour Party may abandon the Capital Levy in favour of an increase in the Income Tax, though this has failed to galvanise attention in cable stocks and shares, upon which the dividends are paid free of tax.

Marconis, after dipping to 39s. 3d., recovered to their previous price of 2 1/16, and Radio ordinary, still bought from America, have advanced to 19s. 9d., the preference remaining steady at 19s. United River Plates further receded to 6⅞, on the intention to issue more capital, which will take the shape of ordinary shares offered at a price that will give present proprietors a useful bonus.

Brazilian Tractions have already been mentioned as a particularly bright spot, and British Columbia deferred at 99 x.d. has recovered 30s. of the dividend deduction made last week. The other stocks of the company are also very firm. Anglo-Argentines remain heavy, and nothing new has occurred to improve the position of Mexicans, the utility issues remaining at their lower prices of last week.

Edison-Swan debenture came into demand, and, there being little stock on offer, the price rose 4 points to 70½. This is the principal improvement in the list of manufacturing companies' shares. English Electric Preference strengthened to their par value of 20s. Telegraph Constructions are 10s. down at 23, in sympathy with the heaviness of the Eastern cable group. Small falls have occurred in British Insulated Ordinary, Henleys, and General Electrics. Babcock & Wilcox went back to 44s. 6d. It should be mentioned here that in our list of comparisons between the prices at the end of 1922 and 1923, an error occurred in showing Babcocks as having fallen 25s. during the year. The capital was doubled, of course, last May, and the price of the shares consequently halved. Therefore the net movement on the year was a rise of £1 per share.

The rubber market is no better, the price of the raw material having receded to 1s. 2d. per lb. Most of the iron, steel and kindred companies' shares show losses ranging from 3d. to 1s. 3d. per share by reason of a little pressure to sell in a market devoid of support.

# Share List of Electrical Companies.

### HOME ELECTRICITY COMPANIES.

| | Nom. | Dividend. 1921. | Dividend. 1923. | Price Jan. 14, 1924. | Rise or fall. | Yield. p.c. |
|---|---|---|---|---|---|---|
| | £ | | | | | |
| Brompton Ordinary | 1 | 12 | 12 | 38/9 | −9d. | £2 3 0 |
| Charing Cross Ordinary | 5 | 9 | 14½ | 14½ | + ⅜ | 4 19 1 |
| do. do. do. 4½ Pref. | 5 | 4½ | 4½ | 4¼ | − ½ | 5 7 5 |
| Chelsea | 1 | 6 | 10 | 97/- | — | 5 11 1 |
| City of London | 1 | 14 | 15 | 28 | − ⅛ | 6 13 4 |
| do. do. 6 % Pref. | 1 | 6 | 6 | 22/- | — | 5 9 1 |
| County of London | 1 | 6 | 10 | 2 | −6d. | 5 0 0 |
| do. do. 6 % Pref. | 1 | 6 | 6 | 22/- | — | 5 9 1 |
| Edmundson's Ordinary | 8 | Nil | 7 | 3¼ | − ⅛ | 5 9 5 |
| do. 6 % Pref | 5 | 12/- | 6 | 5½xd | — | 6 0 0 |
| Kensington Ordinary | 5 | 10 | 12 | 10¾ | — | 5 15 6 |
| London Electric | 8 | 4 | 10 | 4¾ | − ⅛ | 6 7 8 |
| do. do. 6 % Pref. | 5 | 6 | 6 | 5½ | — | 5 9 1 |
| Metropolitan | 1 | 7 | 8½ | 33/9 | — | 5 0 0 |
| do. 4½ % Pref. | 1 | 4½ | 4½ | 17/- | −6d. | 5 6 0 |
| Newcastle-on-Tyne Ordinary | 1 | Nil | 2½ | 16/3 | — | 3 1 6 |
| do. 5 % Pref. | 1 | 5 | 5 | 15/6 | — | 6 9 0 |
| do. 7 % Pref. | 1 | 7 | 7 | 22 6 | −6d. | 6 4 5 |
| Notting Hill 6 % Pref. | 10 | 6 | 6 | 9½ | — | 6 6 4 |
| North Met. Elec. 6 % Pref. | 1 | 6 | 6 | 22/- | — | 5 9 1 |
| Urban Ordinary | 1 | Nil | — | 17/3 | − 1/16 | Nil |
| do. 6 % Pref. | 1 | 2½ | 5 | 17/6 | − 1/16 | 6 17 8 |
| St. James' and Pall Mall | 5 | 12 | 14½ | 11½ | + ⅛ | 6 3 5 |
| South London | 1 | 7 | 10 | 1⅛ | — | 5 8 8 |
| South Metropolitan Pref. | 1 | 7 | 7 | 24/6 | — | 5 14 9 |
| Westminster Ordinary | 5 | 10 | 12 | 10 | − 1/16 | 6 0 0 |
| Whitehall Elec. Invst., 7½ % Pf. | 1 | 7½ | 7½ | 19/9 | — | 7 8 1 |

### HOME RAILS.

| | | | | | | |
|---|---|---|---|---|---|---|
| Central London Ord. Assented | Stock | 4 | 4 | 73 | — | 5 9 7 |
| Metropolitan | " | 2½ | 3½ | 73 | — | 4 17 3 |
| do. District | " | 1 | 3 | 53 | −1 | 5 13 2 |
| Underground Electric Ordinary | 10 | Nil | Nil | 2¼ | − ⅛ | Nil |
| do. do. "A" | 1 | Nil | Nil | 7/6 | −6d. | Nil |
| do. do. Income | Bonds | 4 | 5 | 100 | −1 | £5 0 0 |

### TELEGRAPHS AND TELEPHONES.

| | | | | | | |
|---|---|---|---|---|---|---|
| Anglo-Am. Tel. Pref. | Stock | 6 | 6 | 103½ | — | 5 15 11 |
| do. Def. | " | 1½ | 84/6 | 23½ | — | 6 9 0 |
| Chile Telephone | 5 | 6 | 6 | 5¾xd | — | 5 2 9 |
| Cuba Sub. Ord. | 10 | 7 | 7 | 7½ | + ¼ | 9 13 3 |
| Eastern Extension | 10 | 10 | 10 | 15¾xd | − ⅛ | 6 7 0 |
| Eastern Tel. Ord. | Stock | 10 | 10 | 160xd | — | 6 5 0 |
| Globe Tel. and T. Ord. | 10 | 10 | 10 | 16½ | − ½ | 6 1 3 |
| do. do. Pref. | 10 | 6 | 6 | 10¾ | − ⅛ | 5 11 7 |
| Great Northern Tel. | 10 | 24 | 22 | 28 | — | 7 17 3 |
| Indo-European | 25 | 10 | 7 | 23½ | — | £5 7 8 |
| Marconi | 1 | 25 | 15 | 9 1/16 | — | 7 5 6 |
| Oriental Telephone Ord. | 1 | 12 | 12 | 11¾ | — | £8 8 0 |
| United R. Plate Tel. | 5 | 8 | 8 | 6⅞ | − ⅛ | £6 5 6 |
| West India and Panama | 10 | Nil | Nil | 1/- | — | Nil |
| Western Telegraph | 10 | 10 | 10 | 15¾ | + ¼ | £8 8 0 |

### HOME AND FOREIGN TRAMS, &c.

| | | | | | | |
|---|---|---|---|---|---|---|
| Anglo-Arg. Trams. First Pref. | 5 | 6½ | 12½ | 8 | — | 9 1 6 |
| do. do. 2nd Pref. | 5 | Nil | 8½ | 2⅛ | — | 9 15 8 |
| do. do. 5% Deb. | Stock | 5 | 5 | 75½ | — | 6 12 5 |
| British Electric Traction Ord. | " | 4½ | 5 | 67 | — | 7 9 3 |
| do. do. 6% Pref. | " | 6 | 6 | 98½ | — | 6 1 10 |
| Brazil Traction | 100 | Nil | 4 | 53 | + ¼ | 7 10 10 |
| Brit. Columbia Elec. Ry. Fcs. | Stock | 8 | 8 | 85¼xd | +2 | 5 17 0 |
| do. do. Preferred | " | 5 | 9/- | 8½ | — | £5 12 3 |
| do. do. Deferred | " | 8 | 17/- | 99 | +1½ | £8 10 6 |
| do. do. Deb. | " | 4½ | 4½ | 79½ | — | 5 8 3 |
| Lond. & Sub. Trac. 5 % Pref. | 1 | 5½ | 5 | 6/- | −6d. | 16 13 4 |
| London United Tram. Deb. | Stock | 4 | 4 | 56½ | −1 | 7 1 7 |
| Mexico Trams. 5 % Bonds | — | Nil | Nil | 69½ | — | 7 4 0 |
| do. 6 % Bonds | — | Nil | Nil | 80½ | — | Nil |
| Mexican Light Common | 100 | Nil | Nil | 18 | — | Nil |
| do. Pref. | 100 | Nil | Nil | 44½ | — | Nil |
| do. 1st Bonds | — | Nil | 5 | 59½ | — | 8 8 0 |

### MANUFACTURING COMPANIES.

| | | | | | | |
|---|---|---|---|---|---|---|
| Babcock & Wilcox | 1 | 15 | 20 | 44/6 | −6d. | £4 9 11 |
| British Aluminium Ord. | 1 | 10 | 5 | 18/9 | — | 5 6 8 |
| British Insulated Ord. | 1 | 15 | 15 | 2¾ | − 1/16 | 5 5 4 |
| Callenders | 1 | 15 | 15 | 2¾ | — | 5 5 4 |
| do. 6½ Pref. | 1 | 6½ | 6½ | 24/9 | — | 5 7 3 |
| Crompton Ord. | 1 | 10 | 5 | ¾ | — | 10 0 0 |
| Edison-Swan | 4/- | 10 | Nil | 4/6 | — | Nil |
| do. do. 5% Deb. | Stock | 5 | 5 | 70½ | +4 | 7 1 13 |
| Electric Construction | 1 | 10 | 10 | 29/6 | — | 6 15 7 |
| English Electric | 1 | 8 | 5 | 17/- | — | 5 17 0 |
| do. do. Pref. | 1 | 6 | 6 | 1 | +£d. | 6 0 0 |
| Gen. Elec. Pref. | 1 | 6½ | 6½ | 22/- | — | 5 18 1 |
| do. Ord. | 1 | 10 | 5 | 19/3 | −6d. | 5 4 0 |
| Henley | 1 | 15 | 15 | 2¾ | −9d. | 6 5 4 |
| do. 4½ Pref. | 5 | 4½ | 4½ | 4¼ | — | 5 5 10 |
| India-Rubber | 1 | 10 | — | 12/9 | — | £7 3 4 |
| Met.-Vickers Pref. | 2 | 8 | 8 | 2 1/16 | — | 6 14 6 |
| Siemens Ord. | 1 | 10 | 10 | 16/3 | — | Nil |
| Telegraph Con. | 12 | 20 | 20 | 23 | − ½ | £5 4 7 |

*Dividends paid free of Income Tax.

# The Physical Society of London.

## ANNUAL EXHIBITION OF INSTRUMENTS.

(*Continued from page 50.*)

### Eversheds & Vignoles, Ltd.

In addition to the usual forms of recorder (represented by a polyphase recording wattmeter and a leakage recorder), a special type of instrument was shown. This was a combined recording ammeter and operation recorder, illustrating a principle which might be adapted to almost any form of plant record. The accompanying illustration, fig. 5, shows an instrument of this type having pressure and current movements, as well as operation recording pens

Stated in general terms, the object is to provide a clear

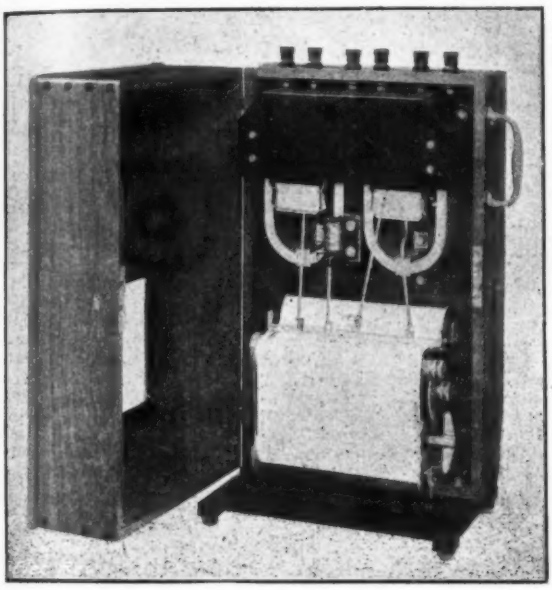


FIG. 5.—RECORDING AMMETER AND OPERATION RECORDER.

and continuous record of the timing of one or more operations in a machine or group of machines, simultaneously with a record of current or power consumption, applied pressure, &c. The importance of this when investigating peak loads or sources of inefficiency in plant will be obvious. By staggering the pens, a large number may be made to record simultaneously, whilst the electrical movements may be arranged to give records of any quantities which can be measured electrically, such as speed, direction, the position of levers, links or valves, &c.

Attention may be called to the most distinctive feature of all the firm's recording instruments, *i.e.*, the straight hour-lines, without which simultaneous records of two or more quantities cannot be obtained.

In contrast to the "Megger" and "Bridge-Megger" testing sets, "Ducter" potential ohmmeter sets are made for the direct measurement of extremely low resistances, ranging from a few ohms down to 1 microhm. The new type exhibited has been rearranged and is now supplied in a teak case almost identical with that used for the "Megger" set. The movement consists of two coils, adapted to measure the ratio of the potential difference to the current flowing between two points on the conductor under test. Current is supplied by a battery connected to two terminals on one end of the instrument, whilst two pairs of terminals at the opposite end are marked for potential and current respectively. To these terminals the special duplex testing spikes are connected, and the hand spikes are merely applied to the resistance which it is desired to test. The spikes are mounted in handles which are marked so that the potential spike in each pair may be readily distinguished, and in making the test the potential spikes must make contact with the conductor in the path of the current which flows between the current spikes. A multiple-range switch is fitted to enable a wide range of resistance to be covered accurately by the one instrument.

Various types of generator were exhibited, all of which have been designed to meet the requirements of radio-telegraphy and telephony for a reliable source of high-pressure current. In the larger generator, however, the armature is wound with two coils to supply both the high- and the low-pressure current necessary for radio transmission. This type has not previously been shown. It is designed for large outputs, reaching the limit which can be obtained by hand operation. The h.p. output is 40 mA at 800 V; the l.p. output is 2 A at 6 V.

### H. W. Sullivan, Ltd.

This firm arranged a demonstration of the heterodyne beat principle to show the constancy of oscillation frequency of standard heterodyne wavemeters. Two thermionic valve heterodyne wavemeters oscillating at 100,000 and 101,000 cycles per second respectively were set up, and these were loosely coupled together by means of low-inductance coupling coils. The resultant heterodyne "beat" frequency of 1,000 cycles due to the superposing of these two oscillatory currents was made audible by a loud speaker after amplification by a two-valve

FIG. 6.—A "DUCTER" POTENTIAL OHMMETER SET.

amplifier. An audio-frequency thermionic valve oscillator (previously calibrated as a standard of audio-frequency) was then set into oscillation at 1,001 cycles per second and, by means of a further variable magnetic coupling, this 1,001 cycles alternating current was superposed upon the 1,000-cycle "beat" current, giving a further very low-frequency "beat" current of 1 cycle per second in the input circuit of the amplifier. After allowing the valves time to settle down to a constant emission and upon further and very delicate

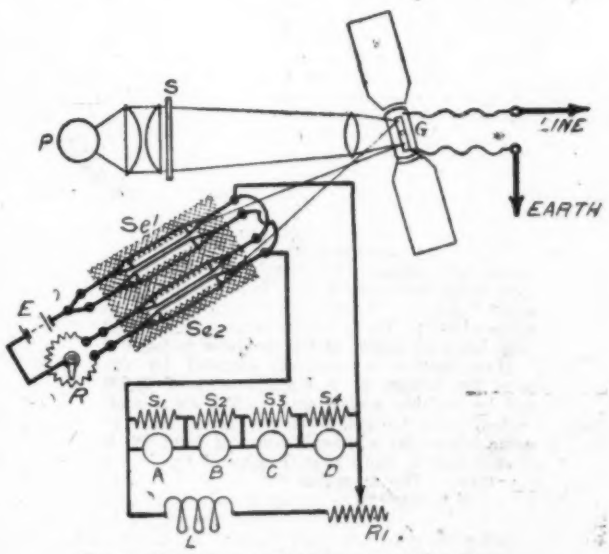



FIG. 7.—PRINCIPLE OF SELENIUM CELL MAGNIFIER.

adjustment of one of the radio-frequency generators to obtain the correct pitch of "beat" note, the final resultant amplitude beat of one per second was loudly and clearly heard from the loud speaker and remained absolutely constant in frequency, thus demonstrating that the heterodyne wavemeters were

oscillating with a constancy of at least one cycle per second in 100,000. In order to obtain the most clearly defined final "beat" the coupling between the audio oscillator output and the rest of the circuit had to be adjusted, to ensure that the 1,000-cycle beat current and the 1,001-cycle current were of approximately equal amplitudes.

Mr. K. C. Cox's selenium magnifier for submarine telegraphy was shown. This instrument is used to increase the working speeds of submarine cables by amplifying the very attenuated signals received at high speed sufficiently to operate ordinary recording or relaying apparatus. It is illustrated diagrammatically in fig. 7.

A beam of light from the source P is projected on the mirror of the receiving galvanometer G and thence to two pairs of selenium cells $se_1$, $se_2$. These cells are arranged as four arms of a bridge, and the beam of light is sub-divided by a grid slide S to correspond with the width of the cells so that with the galvanometer at zero the surface of each of the four cells is half light and half dark and the bridge system is balanced.

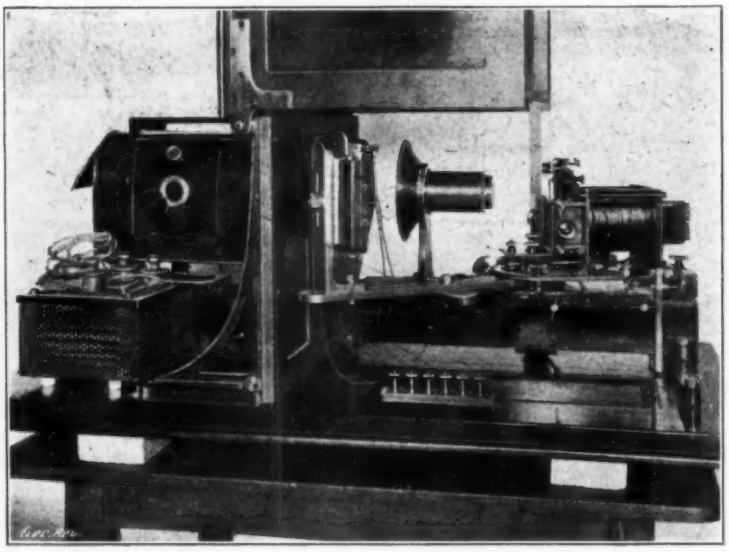


FIG. 8.—A TYPICAL MAGNIFIER EQUIPMENT.

For final adjustment of balance the rheostat R is inserted in the battery circuit at one apex of the bridge. Deflections of the galvanometer by received signals cause corresponding variations in the position of the light area on the cells and large corresponding changes in the relative resistances of the cells, thus actuating one or more instruments A, B, C, and D, which may be arranged as required in the cross circuit of the bridge. In practice a large number or very narrow cells or sections of a cell are used, these being arranged in pairs with one "bar" of light to each pair, so as to make full use of the very small galvanometer deflections obtained when working at high speed on long cables. The various pairs are connected as a series of bridges in parallel.

The success of the system is due to the improved cell used; this is of the "plate" or built-up type. Steadiness of instrumental zero in the magnifier is insured by mounting the component parts—lantern, lens, galvanometer and cell on a cast-iron bed of a lathe type, and by special attention to the design of the galvanometer suspension.

The lens, galvanometer, and cell are enclosed in a dust-proof case. The galvanometer is of the suspended coil type. The permanent field magnet has "hybrid" windings for use when an extra strength of field is required. The standard "Ediswan" 100-c.p. "Pointolite" lamp is ordinarily used as a source of light. Its useful life is from four to eight weeks. With this lamp the action of the amplifier is found to be constant. Magnification is generally adjusted by varying the voltage of the battery E. A magnification of 20,000 may be obtained by making L=500 c.p., B=150 volts, and in some cases sub-dividing the cell further. In ordinary practice in submarine telegraphy a magnification of from 200 to 2,000 is usually sufficient to work a good relay of the Morse or other ordinary type. The magnifier can be used at any speed of signalling and to operate relays or recording apparatus of any type. In fig. 7 the instruments A, B, C, and D are assumed to be of the moving coil type. Reactance of these instruments on each other is avoided by suitably shunting them as shown. Adjustments are simply effected, and when set the apparatus adapts itself automatically to any rate of change in the zero.

The instruments represented by A, B, C, D are usually A, the signalling relay which operates receiving perforators, transmitters, printers, &c., as may be required; B, a siphon recorder suitably adjusted to give an accurate "line record" of the received signals independently of the relays, and used also for duplex balancing purposes; C, the auxiliary relay for zero correction described above; and D, a high-frequency galvanometer for duplex balancing purposes. Fig. 8 illustrates a typical example of the magnifier.

### Adam Hilger, Ltd.

A Low-Hilger "audiometer" was one of the most interesting of this company's exhibits. This is an extremely sensitive optical kymograph, designed to record the pressure variation caused by sound waves. The instrument is enclosed in a polished mahogany case, and is completely self-contained, being ready for plugging direct into a source of electricity supply. The apparatus is illustrated in fig. 9. The sound wave is received by a horn, which is fixed into the diaphragm box shown in the front of the illustration. This horn is made of special millboard wrapped with adhesive rubber tape; this construction eliminates resonance in the horn itself. In the box is mounted an extremely light diaphragm of celluloid, rubber, or other material (according to the sensitivity required), of which a small portion is platinised to form a mirror. The diaphragms are made by a special process resulting in thicknesses down to a fraction of a wavelength of light. Thus the mass is very small and the air damping very great, making for sensitivity and accurate reproduction of wave form. The diaphragm is mounted so as to be optically flat when undeflected. Light is directed from a light source beneath the diaphragm box by a condenser through a slit, and the image of this slit is projected by the platinised area of the diaphragm through two lenses on to photographic paper or film on a drum at the other end of the apparatus. The beam of light is brought to an intense point, so that when the drum rotates a record of the deflection of the diaphragm is made. The light source is a 30-c.p. "Pointolite" lamp, which can be supplied with a suitable resistance. The drum is enclosed in a specially-designed camera box with an automatic exposing arrangement.

Dr. Müller's X-ray spectrograph was also shown. This instrument consists of a support carrying a rotating table for the crystal mount, and passing through the latter a bar of triangular section upon which slide carriers for slit and plate-holders respectively. The support is mounted on a box containing a spring-motor, to the shaft of which is attached a cam. A lever, which can be clamped at any orientation to the axis of the crystal table, is kept in contact with the cam by a spring, and is thus oscillated through a certain angle as the cam rotates. With the cam usually supplied an angle of oscillation of about 12 deg. is obtained. The crystal mount consists of a vertical plate with lead screen, to which the

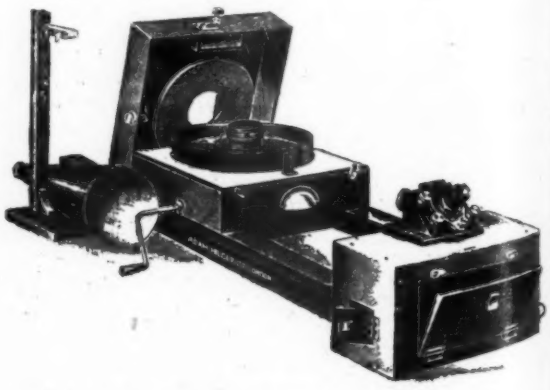


FIG. 9.—THE LOW-HILGER "AUDIOMETER."

crystal can be attached with soft adhesive wax and is provided with tilting adjustment about a horizontal axis. The mount can be traversed in a slide across the rotating table so as to bring the face of the crystal up to the axis of rotation. The edge of the table is divided in degrees to facilitate the setting relative to the lever in order to register lines upon each side of the normal to the photographic plate. Other exhibits by this firm were polarimeters, saccharimeters, spectrographs, interferometer, &c.

*(To be continued.)*

# The Control and Switching of High-Pressure Distribution Systems.

By P. V. HUNTER, C.B.E., M.I.E.E.

*(Abstract of paper read before the* SOCIETE FRANCAISE DES ELECTRICIENS.)

*(Concluded from page* 74.)

## APPENDIX "A."

### THE FOUR-CONDUCTOR PROTECTIVE SYSTEM.

The four-conductor protective system is a simplified combination of the Merz-Price and split-conductor protective systems. As will be seen from the cable section, fig. 4, and the diagram of connections of a three-phase feeder, fig. 5, only one of the phases is split and the conductors S $S_1$ of that phase are at each end connected together through current transformers A $A_1$, which actuate the relays B $B_1$ whenever the currents in S and $S_1$ are unequal.

The arrangement is such that while the feeder is sound the currents in S $S_1$ are always equal, but any kind of fault within the feeder will produce disparity of currents in S $S_1$ and trip

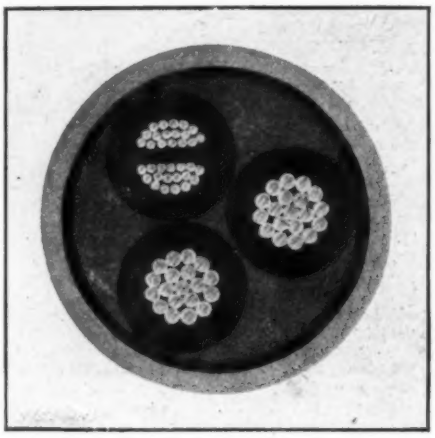


FIG. 4.—SECTION OF CABLE.

the switches. These results are secured by means of the balancing transformers D $D_1$, which embrace the split and unsplit phases. The action of the arrangement for various kinds of fault may be explained as follows:—

*Faults from unsplit phases to earth or to each other.*—Take the case of phase E—while the same current leaves E at one end as it enters it at the other, equal fluxes are produced by it in the cores of S and $S_1$. These fluxes produce e.m.f.'s at each end of S and $S_1$, but the connections are such that the e.m.f.'s are in opposition. As a consequence the normal load currents in S and $S_1$ are undisturbed.

In the event of leakage from E either D or $D_1$ will produce the greater e.m.f. and tend to circulate a current in the closed circuit formed by S and $S_1$, with the result that the equality of currents in the transformer primaries A $A_1$ will be upset, the relays B $B_1$ will be operated, and the switches C and $C_1$ will be opened. A similar sequence of operations would occur in the event of leakage from F, also in the event of a leakage from E to F.

*Faults from unsplit phases to split phase.*—In this case the fault current produces a direct unbalancing of currents in S and $S_1$, and, although the balancing transformers D and $D_1$ may accentuate the inequality of currents in S and $S_1$, this action is not necessary to ensure operation of the relays on the occurrence of such a fault.

*Faults from splits to earth.*—In the event of leakage from either S or $S_1$ to earth a direct unbalancing of the currents is produced and the relays are operated. An equal leakage from S and $S_1$ to earth is the equivalent of a fault between splits described below.

*Faults between splits.*—The balancing transformers D and $D_1$ trip the relays in the event of a fault between S and $S_1$.

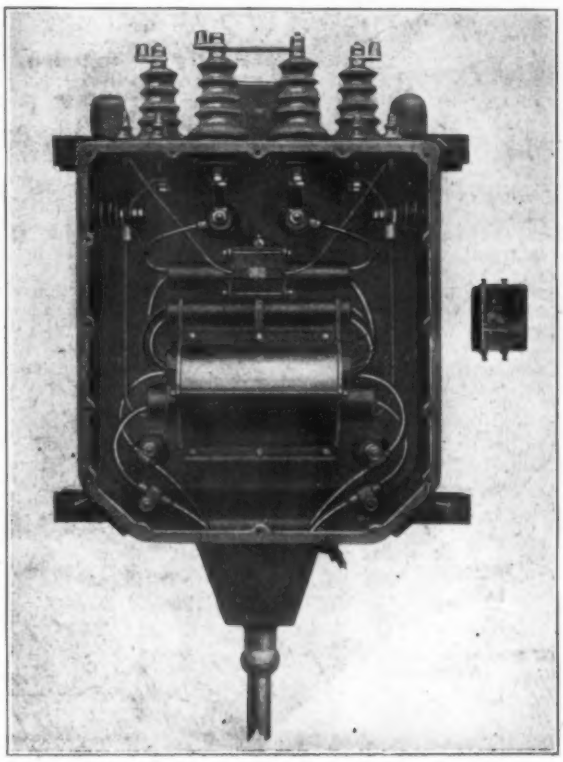


FIG. 6.—CABLE DIVIDING BOX, WITH COVER REMOVED.

When E or F, or both of them, are carrying load a flux exists in the cores of D and $D_1$. These fluxes produce e.m.f.'s in S and $S_1$, which are normally opposed and equal, and therefore do not disturb the currents carried by S and $S_1$. In other words, the effect of the balancing transformer D is to induce an e.m.f. in S and $S_1$ at one end and the effect of balancing transformer $D_1$ is to produce a precisely similar, but opposite, e.m.f. at the other end.

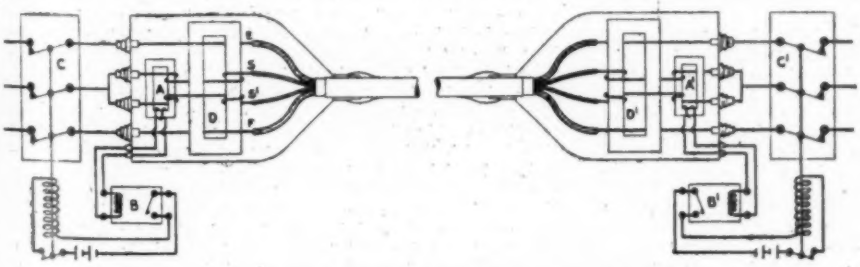



FIG. 5.—CALLENDER-HUNTER SYSTEM, DIAGRAM OF CONNECTIONS.

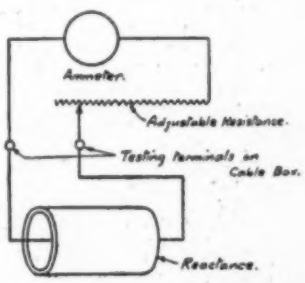



FIG. 7.—ARRANGEMENT FOR TESTING.

If contact be made between S and $S_1$ at any point intermediate of the two ends, the two e.m.f.'s are no longer opposed, but can circulate current each in its own local circuit, with the result that the relays B and $B_1$ are caused to operate.

It is clear from what has been said above that the protective arrangement operates for any form of leakage which may occur within the feeder, whether it be from phase to earth, phase to phase, or between splits, and there is also no combi-

nation of these various kinds of leakages which will prevent the arrangement from operating. A feeder equipped in the manner described will completely ignore faults in other feeders and apparatus, but it will be instantly disconnected in the event of any kind of fault developing within it.

It has been found possible to incorporate the transformers in the cable dividing boxes at each end of the feeder, as shown in fig. 6, which is a view of the dividing box with the lid off, showing the internal arrangement. After the box has been closed, with the equipment in position, it is filled with insulating composition.

An important practical consideration with discriminating protective systems is the fact that the equipment of a particular feeder is very seldom called upon to function, but must at all times be ready to do so. There is, however, generally no way of testing it to make sure that the equipment is in order, beyond operating the relay by hand. In the case of the four-conductor sytsem, however, it is possible to test the functioning of the whole equipment in the same way as if a fault had actually occurred. For this purpose an insulated bar is passed through the core of each balancing transformer, the ends of each bar being connected to terminals brought out of the dividing box. When it is desired to test the equipment the bar at either end of the feeder is short circuited through a resistance as shown in fig. 7, when a current will flow in the bar circuit due to the flux in the core produced by the load current. This current will have the effect of upsetting the balance of the whole arrangement, and in this way the relays at each end may be caused to operate.

If desired the resistance may be a regulating one, with an ammeter in circuit with it, and by slowly reducing the resistance the actual current at which the relay operates may be determined. It is also possible to cause the relay to operate by circulating a current through the bar from an outside source.

In "Appendix B" the author explained the Fawssett system, which was fully described in the ELECTRICAL REVIEW of October 26th, 1923, p. 608.

# The Electrical Trade in Burma.

By "A. W."

BURMA, so far as the electrical trade is concerned, is an extension of India; most of the European concerns which cater for India have connections in Burma. Rangoon is the principle centre, with Mandalay next. At Rangoon the local supply company does a considerable trade in installations and sales of apparatus. There are openings practically everywhere for increase. The Burmese are an enlightened race, and well aware of the advantages of electricity; they carry on business on identical lines to the Hindu and Mohammedan. As a matter of fact a good many small traders in Burma are Indians.

At the present time prospects are exceptionally good in installation work; new theatres, kinemas and other works are in progress or contemplated this year. In addition more than one concern has commenced film production on a large scale, and will be in the market for lighting equipment.

The principal item of trade is the fan (as in India) and in a minor way, the electrically-driven punkah. Further down the coast and also north of Rangoon there is unlimited scope for prospective trade. In the case of Moulmein (a port of call) the writer met several mining rperesentatives who anticipated business at an early date, apart from the prospects offered by the islands near by. North of Rangoon is already a busy oil centre, using a considerable amount of electrical equipment. Generally speaking, trade in Burma is good in every line, but not good enough for newcomers who wish to open out, unless they are also in touch with India or Ceylon. The distance from Ceylon is, however, considerable, and Calcutta is considered the most important and the nearest route (by direct mail line) to Rangoon.

Practically all the European concerns and supply companies have offices in London, and in a good many instances traders also have either representatives or shipping agents in the City; therefore interested parties cannot do better than get into touch with these agents or the Government departments prior to opening out new business. An agent will always be pleased to pass on samples and publicity matter to his friends in Burma.

Apart from fans, Burma offers one of the best markets for surface and overhead wiring material. C.t.s. and similar wiring systems should have a good reception once the advantages have been grasped. Simplicity, cheapness, ease of erection, all attract the native, especially when the material is considered ideal for damp climates. Outside Rangoon most places are at some distance from the supply, and heavy steel conduit is out of question on grounds of cost alone, the ordinary cable being used meanwhile on account of cheapness. The writer cannot say that Burmese are any better in wiring and other work than the Indian, possibly not so good, hence the reason why a simple wiring system merits attention.

Most of the notes in the previous article ("Electrical Trade in India," ELECTRICAL REVIEW, October 12th, p. 530) apply also to Burma, yet here the people are only too willing to become modernised. There is a distinct desire to advance with the times. A member of the Rangoon Supply Co. informed the writer that the company did a great business in fans, &c., thus proving that the contention in the previous article was correct, *i.e.*, that every concern which sets out to attract custom can do so in spite of competition. Bazaars and dealers will also state that they could do more business if better material was offered. As regards other accessories the gasfilled lamp is undoubtedly the premier item; the Oriental, strange to say, appreciates nothing better in these days than a bright light and natural colour, yet most of the lighting is by crude oil lamps, even in the temples.

As regards heavy plant, Burma offers room for improvement, as considerable trade is still being done in oil engines as prime movers.

Naturally, as a number of oil companies have their supply wells in Burma, it would be reasonable to presume that fuel for engines was cheap enough to eliminate competition from electricity. But this is not so, as there are large supply companies in the East capable of meeting any demand at a competitive rate for power and light.

As most of the heavy mining machinery is in the open, or at most covered with the flimsy native thatched roofs in the early stage, it is imperative that it be of the enclosed type, preferably pipe ventilated, for the temperature is excessive.

For obvious reasons transformers and allied equipment are seldom carried in stock by traders, and never in the bazaars, but are ordered direct from the works or stocks held by manufacturers' agents in the large cities. To sum up, the native dealer does not stock goods which he does not understand.

Finally, I should like to draw attention to an opening in small accessories, portable devices, as magneto lamps, electrically-lighted shaving mirrors, soldering irons, &c. These are the things which the small trader wants, as well as irons, heaters, coffee pots, &c. The last three items are already stocked by most native dealers.

A word here will not be out of place concerning the conditions in the East as they affect Europeans. There is no opportunity for the skilled or unskilled workman, unless a vacancy occurs through illness, or loss or increase of staff; thus there is little or no chance for the man who emigrates on speculation. The average cost of residence in India, or Burma, in a decent hotel, or flat, is Rs. 250 per month upwards; in addition to this a servant is a necessity and a nuisance. Petty expenses will add another, say, Rs. 150 more or less, bringing the total to Rs. 400. Consider the single man first. He will want to pass the evenings away after a day in the tropical sun, and may select either a club, amusement, or, as is generally the case, both, thus adding a not inconsiderable item to the already formidable account, possibly another Rs. 150. In the case of a married man, in the same circumstances, a great deal would depend on the size of his family; if none, then on the wife's mental attitude after a dull and tiresome day. Speaking personally, the writer finds it an advantage to be married when in the East. The total expenses seldom exceed the amount the single man is inclined to spend. It is possible to live in the tropics more cheaply, but certainly not in comfort and decency. The minimum salary for a single man should be Rs. 800 per month; anything less means going out to a hot and difficult climate with little or no financial advantage, and possibly a serious breakdown in health, with a return home, cancellation of contract, and nothing to look forward to on arrival. For a salesman, manager, or a man in a superior position to an artisan, the minimum salary should be not less than Rs. 1,000, as he will be expected to reside in superior surroundings and spend more on clothing (no small item, in spite of cheap labour). The average cost in first-rate flats and hotels will average anything over Rs. 500 per month. Last, no person should go out to the Far East without making sure of his salary and passage out and home, otherwise he will find himself seriously in debt and at the mercy of the native. Once down in the East there is no quick method of getting up, and very little prospect of friends' help in many instances.

Once you have made good without injury to your health you find the country like any other, worth the trouble and the risk.

# New Electrical Devices, Fittings, and Plant.

*Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.*

## The "S. & C." Fuse Carrier.

The common form of fuse carrier employing porcelain in its construction is admittedly weak mechanically, the fragile nature of the porcelain being a chief drawback. A new type of carrier made by MESSRS. SWITCHGEAR & COWANS, LTD., Elsinore Road, Old Trafford, Manchester, is practically indestructible, both the handle and the detachable fuse baffle being moulded in an insulating material made by a special process, which is of great mechanical strength, is non-hygroscopic, and does not scale or disintegrate. Another notable feature is the absence of small screws; with the exception of the terminal screws, no small screws whatever are used in the construction of the carrier or contacts.

Although specially developed for use with the well-known S. & C. unit type ironclad airbreak switchgear, the improved S. & C. fuse carrier is designed for universal application where fuses are required to be enclosed, being particularly suitable for industrial type distribution boxes, street feeder pillars, airbreak gate end switches and the like, and suitable stationary contacts are standardised for mounting either on slate bases or insulated bars of various forms. The handle is made in halves, divided vertically (see fig. 1), each half being identical and interchangeable. The halves are tongued and grooved, both to facilitate assembly and to prevent all possibility of fused metal blowing through to the operator's hand. The halves are held together securely by two strong brass bolts with nuts coated with insulating material, the coating being applied merely for appearance, as the bolts cannot be made alive. Ample material is embodied in the construction of the handle, which is designed to provide comfortable accommodation for the hand and fingers ensuring that a good grip is obtained, with freedom from danger of touching live parts or being exposed to a "blowing" fuse. The formation of the handle provides a channel in which recesses are formed to locate the contacts and the clip for holding the fuse baffle. To insert these parts the handle is opened up by removing the two bolts, then the contact blocks and fuse baffle clip can be placed in their respective recesses and are locked in position when the halves of the handle are bolted together.

In fig. 1 the carrier is shown fitted with contacts of the bent-over spring type for use with S. & C. unit type ironclad airbreak switchgear, but these can readily be exchanged for the tongue type, where the spring contacts are on the switchboard. The renewable contacts are made from heavy copper strip mounted on gunmetal blocks formed with lugs which fit, without binding, into recesses in the handle.

The contact blocks are each fitted with a terminal plate, and screws for securing the ends of the fuse, the large area of the plates ensuring good electrical contact. The ends of the fuse pass through a recess in each block, and are bent over to come under the plates, which are formed with locating lugs so that they can be dropped, without adjustment, into position on the blocks.

The fuse wires are enclosed in an ingeniously-designed baffle in the form of a split block of non-inflammable insulating material. The baffle fills the space between the upper and lower contacts, and thus acts as a guide when inserting the fuse carrier into the stationary contacts. As shown in fig. 2, the baffle is divided vertically, being made in two identical halves which, when united, are firmly locked as if in one piece, by dovetailed projections fitting into corresponding recesses. A simple sliding movement is all that is necessary to engage or disengage the two halves of the baffle. The fuse wire is situated in a vertical passage near one edge of the baffle, and from this passage horizontal ducts extend into a vent communicating with the atmosphere. When the fuse is blown the gases escape immediately along the horizontal ducts to the vent, while cold air is drawn into the baffle through the enlarged ends of the fuse passage, the baffle being instantly cooled. The operation of withdrawing the fuse baffle from the carrier, opening it up and inserting a new fuse can be accomplished in a few minutes without removing and replacing any screws other than the terminal screws. The baffle is held in position in the carrier by a strong phosphor-bronze clip formed so that it is secured, without screws, in recesses in the handle midway between the upper and lower contacts. The capacity of the fuse in amperes, and the gauge of wire to be used are indelibly stamped on the handle.

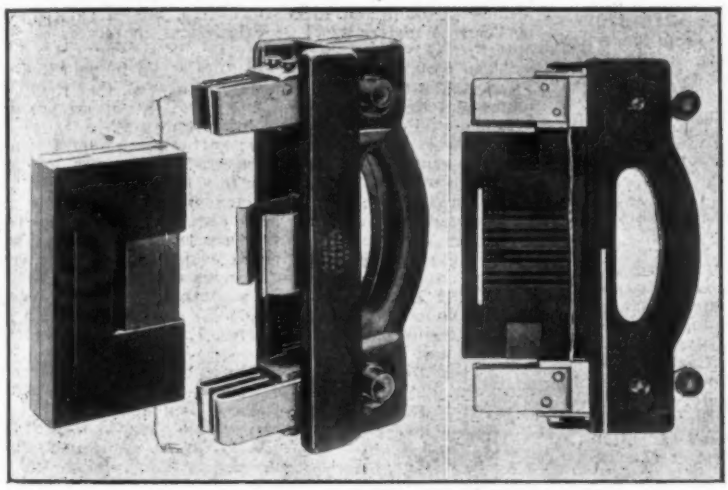


FIG. 1.—THE "S. & C." FUSE CARRIER. FIG. 2.—ONE HALF OF CARRIER.

## The Sterling "Dome" Loud Speaker.

Fig. 3 illustrates a development by the STERLING TELEPHONE AND ELECTRIC CO., LTD., 210-212, Tottenham Court Road, W.1, of its ordinary type of loud speaker for radio-telephony. The base is of the standard "Sterling" type, but instead of the usual horn an inverted metal bowl is mounted upon it. The result is excellent, although, of course, the volume of sound emitted is reduced. By means of a diaphragm screw the loud speaker is easily adjusted. Apart from its merits as a reproducer it is also decorative, being ornamented with a black and gold shadow design.

FIG. 3.—THE "DOME" LOUD SPEAKER.

## The "Dred-Nort" Disconnecting Box.

MR. GEORGE P. COSWAY, The Arcade, Nuneaton, has designed, in conjunction with the LEICESTERSHIRE & WARWICKSHIRE ELECTRIC POWER CO., a special type of link disconnecting box so arranged as to facilitate jointing. The "Dred-Nort," as it has been named, is illustrated in fig. 4. It consists of one main casting, which contains a baseboard of special composition, non-hygroscopic, and possessing high insulating properties. The baseboard is isolated from the bottom of the casting by four glazed porcelain insulators, and to this board are secured the necessary copper strips and vertical "L" pieces for the internal connections. The copper fittings are of generous proportions, being 60 per cent. greater in section than the cable for which the box is designed. The clearances between fittings of opposite phase or polarity are also greater than usual. The copper conductors to which the cables are attached leave the box and enter the gland through an oil-impregnated teak bush. The conductors are so spaced as to allow ready access to the machined sweating thimbles which are bolted to them. To prevent the collection of water in the box by condensation or other cause, the links of the same polarity or phase are shrouded by a hard fibre fillet, enclosing them in separate compartments. As the fillets project some distance above the links, it is impossible for them to be short-circuited by the accidental dropping of tools, &c. The lid is of the diving bell pattern, with cast-iron locating strips to ensure that the lid is placed into the correct position. The standard gland is fitted with a wood bush and a lead die bond, which is pinned to the casting to ensure continuity

with the lead sheathing. Arrangements are made for blanking off spare "ways," and the lid of the gland and the top of the blanking-off piece are provided with a small trough into which compound can be poured to secure watertight conditions. Among the advantages claimed for the box are that

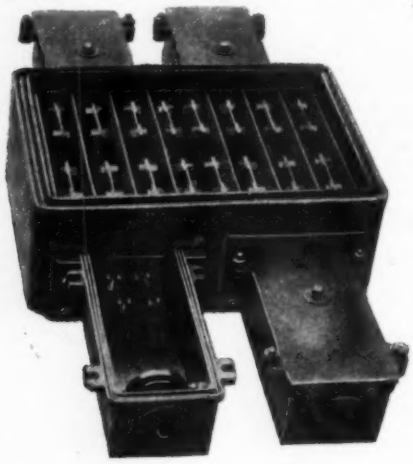


FIG. 4.—THE DRED-NORT DISCONNECTING BOX.

any cable can be fitted or removed at any time without making any of the others "dead"; the box can be assembled and filled with compound at the bench; there are no joints to work loose under the compound; the contacts are accessible for cleaning; and the box can be removed for repairs without cutting any cables. The box can be used as a terminal box, or as a straight-through, three-way, or four-way link box.

## The "Model Engineer" Exhibition.

As briefly stated in our last issue, this exhibition was held at the Royal Horticultural Hall, Westminster, from January 4th to 11th. It was the seventh of a series and the collection of models exhibited appeared to maintain the high standard reached on previous occasions. The excellent workmanship and ingenuity displayed in the models is something of a revelation to those who see them for the first time. Model locomotives drawing loads far above the limit apparently imposed by their diminutiveness; tiny internal combustion engines complete to the last bolt; Lilliputian motors and generators; aircraft and ships; and many other reproductions accurate in every detail, appeared as usual.

The trade side of the show was, of course, very prominent, and attracted the attention of amateur engineers even more than the models. Electrical and radio apparatus was exhibited by a number of firms, among whom the following may be mentioned:—

MESSRS. GRIGG, LTD., showed a 1-kW lighting set, consisting of a generator coupled directly to a 2½-h.p. two-stroke petrol-oil engine.

THE WAINWRIGHT MANUFACTURING CO., LTD., displayed a large amount of radio apparatus, conspicuous among which were condensers, fixed and variable, of excellent workmanship. The firm showed a complete set of components for a three-valve receiving set, ready for assembly. All crystal detectors fitted to sets were of a special pattern, easily adjusted and maintained in position.

The ECONOMIC ELECTRIC, LTD., displayed many small gas and oil engines, dynamos and motors, electro-medical apparatus, "Xtraudion" radio valves, loud speakers, charging boards, radio receiving sets, &c.

MESSRS. WILL DAY, LTD., showed a number of "Witton" fractional h.p. motors, "Igranic" and other radio apparatus, intervalve transformers, &c. A feature of this stand was a novel type of loud speaker. This consists of a papier-mache box, upon which is mounted a horn of the usual shape, made of the same material. Into two recesses in the box an ordinary pair of head-'phones is fitted, being kept in position by the head-band. We did not hear the arrangement demonstrated but it was stated that it is very effective where the strength of speech in the receiver is too great for the ears.

MESSRS. PETO-SCOTT, LTD., among a number of receiving sets of various patterns, showed a prettily-decorated crystal set intended for children. A device for enabling a bell installation to be used as an aerial was exhibited. THE RAWLPLUG CO., LTD., without whose display no exhibition is now complete, demonstrated the use of its screw-fixing devices. THE BOWYER LOWE CO., LTD., had a wide range of radio receiving sets, parts, and accessories. THE BOWER ELECTRIC CO., LTD., also exhibited radio apparatus, as well as high-frequency electrical machines, with glass electrodes, &c. THE GRAFTON ELECTRIC CO. displayed small electrical appliances and apparatus of many kinds, including small dynamos, accumulators, loud speakers, radio apparatus, switches, &c.

*Experimental Wireless* exhibited some apparatus, and gave demonstrations in a comfortable lounge in the Hall.

In conclusion, it may be said that the show indicated a growing interest in technical design and construction, and as a stimulus to this spirit the exhibition is of considerable value.

The organisers, Messrs. PERCIVAL MARSHALL & CO., are to be congratulated on having got together a very interesting display.

## Calculating the Temperature of Electrically-Heated Wires.

Messrs. A. C. SCOTT & CO., LTD., of Manchester,, have sent us the following communication:—

"We have read with interest the article in the ELECTRICAL REVIEW of December 28th under the following heading 'A General Formula for Calculating theTemperature of Electrically-heated Wires,' and consider the information given therein as being of a most useful character, more especially as it serves to eliminate a deal of slide-rule work in the figuring of hot and cold resistances.

"We are not surprised to note that the author elects to ignore the temperature co-efficient of electrical resistivity factor in his calculations, as very few manufacturers of resistance materials make available reliable, or even useful, data on this point. Nevertheless, the temperature-resistance characteristics of certain materials, particularly those of the nickel-chromium and nickel-steel class, are of sufficient importance to materially affect calculations in respect of wires operating at red heat.

"The temperature co-efficient data given in your Table of Physical Constants, with two exceptions, *i.e.*, that relative to Cekas and Kruppin material, are quite useless in practice: first, because it is not stated what temperature range the quoted figures purport to cover; secondly, and most importantly, because the temperature-resistance curves of most resistance wires do not conform to a straight line, as will be seen from the attached table concerning the more important of our resistance wires, which are standard with some of those dealt with by the author of your article. It will be seen that, in the case of 'Cromaloy' wire, which is of similar grade to our 'Calido' and 'Cekas,' the resistance at 1,000 deg. C. is 15.4 per cent. above cold resistance. A most marked example is found in our 'Feraloy II,' a 0.87 ohm/metre/mm wire, which increases in resistance by 50 per cent. between 20 deg. C. and 700 deg. C.

"As the wires mentioned in the attached table are standard products, the data we give concerning these may be of sufficient general interest to warrant their publication.

"As the formula you have published offers so excellent an amplification of our own available data, we would like to have your permission to reproduce extracts therefrom for embodiment in our tables."

TEMPERATURE-RESISTANCE CHARACTERISTICS OF RESISTANCE MATERIALS.

Unit represents Specific Resistance at 20° C.

(See Physical Constants Table.)

| Material. | Degrees Centigrade. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 20° | 50° | 100° | 300° | 500° | 700° | 800° | 900° | 1,000° |
| | For resistance at above temperatures multiply by— | | | | | | | | |
| Cromaloy ... | 1·000 | 1·012 | 1·027 | 1·075 | 1·109 | 1·118 | 1·127 | 1·139 | 1·154 |
| Cromaloy II | 1·000 | 1·004 | 1·015 | 1·045 | 1·074 | 1·076 | 1·084 | 1·098 | 1·112 |
| Cromaloy III | 1·000 | 1·005 | 1·016 | 1·047 | 1·075 | 1·078 | 1·087 | 1·101 | 1·116 |
| Cromaloy IV | 1·000 | 1·004 | 1·012 | 1·039 | 1·061 | 1·055 | 1·064 | 1·068 | 1·080 |
| Feraloy II... | 1·000 | 1·028 | 1·083 | 1·289 | 1·416 | 1·500 | 1·535 | | |
| Constantan | 1·000 | 0·997 | 0·993 | 1·002 | 1·019 | | | | |
| Manganin ... | 1·000 | 1·0006 | 0·9986 | | | | | | |

PHYSICAL CONSTANTS OF RESISTANCE MATERIALS.

| Material. | Composition. | Specific resistance in ohms per metre 1 mm.² section at 20° C. | Coefficient of linear expansion per °C. 20 — 100° C. | Maximum continuous working temperature deg. C. | Approximate melting point deg. C. | Specific gravity. |
|---|---|---|---|---|---|---|
| Cromaloy | Nickel-chrome-iron | 1·1 | 1·64 × 10⁻⁵ | 950 | 1,360 | 8·25 |
| Cromaloy II | Nickel-chrome-iron | 1·1 | 1·58 × 10⁻⁵ | 1,000 | 1,370 | 8·15 |
| Cromaloy III | Nickel-chrome | 0·95 | 1·5 × 10⁻⁵ | 1,100 | 1,380 | 8·25 |
| Cromaloy IV | Nickel-chrome | 1·0 | 1·5 × 10⁻⁵ | 1,150 | 1,390 | 8·35 |
| Feraloy II | Nickel-steel-chrome | 0·87 | 1·71 × 10⁻⁵ | 650 | 1,480 | 8·15 |
| Constantan | Copper-nickel | 0·49 | 1·44 × 10⁻⁵ | 800 | 1,290 | 8·9 |
| Manganin | Copper-manganese-nickel | 0·40 | 1·76 × 10⁻⁵ | — | — | 8·15 |

# The Electrification of the French Midi Railway.

## Resumed Discussion in London.

THE discussion of the paper by Mr. A. BACHELLERY, which was read in November at the INSTITUTION OF ELECTRICAL ENGINEERS, and abstracted (with the first part of the discussion) in our issue of November 30th (p. 832), was resumed at the Institution on January 10th.

Mr. J. E. SAYERS (London, Midland and Scottish Railway) characterised the work described as an unprejudiced application of electrical engineering to a difficult problem. Experiments to counteract the effects of induction by single-phase current had been carried out some years ago by the Midland Railway. The employment of counter-inductive wires seemed to him familiar and he had found that the system was very similar to a method patented earlier by himself. The use of these wires was comparatively simple in connection with single lines, but when three or four tracks were concerned they became far too complicated. He had tried a method of charging telegraph wires with a condenser, and although it was successful on short lines it was not easy to apply to long trunk lines. As higher pressures became available for d.c. work his company had formed the opinion that d.c. was much better on account of its non-inductive nature. The contact system employed on the Midi Railway was similar to that adopted by his (the speaker's) company. In this direction the chief trouble was a suitable design for the pull-off insulators. Foreign-made porcelain insulators with cemented iron caps had been found to be unsatisfactory owing to the nature of the cement. The elimination of pull-offs had been aimed at and by means of diagrams the speaker explained the system adopted. Joints were avoided in the contact wire; 1,000-yd. lengths were used, and the junctions of contact wires were made with a few turns of cable; this also formed a protection against current surges from lightning and short circuits. Referring to the collection of static charges on wires, the speaker said that he knew of a case in which men had received severe shocks from a static charge on a wire 52 ft. from the ground. The supply of d.c. from power stations generating a.c. was handicapped by the prejudice which existed in this country against the use of large 50-cycle converters. It might be better to install large frequency-changers, or to devote plant entirely to the supply of power to the railways.

Mr. F. LYDALL said that the experience of many systems gained by the Midi Railway since 1902 was of considerable value in the study of the electrification of British railways. We were not only concerned with ourselves, foreign conditions must be carefully studied for the benefit of our export business. There might be circumstances in which the single-phase system would have to be considered in spite of the Ministry of Transport Committee's recommendations. The loads to be dealt with appeared to be often very large to be handled by means of d.c. The speaker had inspected the Midi system. Referring to the sub-stations, he said that no precautions against flashovers appeared to have been taken except for the provision of high-speed circuit breakers. Flashovers had occurred and the machines had had to be shut down and the commutators cleaned up—sometimes a matter of 30 or 40 minutes. The steps taken by British manufacturers to enable flashovers to occur without involving a shut-down might be considered extravagant, but they were necessary in traction work. There appeared to be no lightning arresters apart from condensers shunted by inductances. With regard to the mercury vapour rectifiers more information was necessary. Mr. R. L. Morrison had stated recently that back-fires and other troubles had *practically* been got over. What was meant by this exactly? Even if the efficiency figures given by Mr. Morrison included transformer losses, rectifiers did not seem to be much in advance of 50-cycle converters in this respect. The speaker said that the freight locomotives travelled very smoothly at high speeds (from 50 to 55 m.p.h.) in spite of the indifferent maintenance of the track, and many curves. The arrangement of the locomotive gear was good except that it was not very easy to get at the back of the switchgear. He wished to know if the twin-motor gear was equipped with a spring drive, and also if rheostatic braking did not involve very large resistances. The fact that the Midi Railway had decided against regenerative braking did not put this system out of court; it was being employed with success on the American continent. Dealing with oscillations, the speaker said that Sir Vincent Raven had stated that in America this was probably due to the fact that the rail joints were staggered from side to side and the frequency of the vibrations thus caused synchronised with the natural frequency of the locomotive. The question of oscillations was discussed in the *Revue Générale d'Electricité* in December, 1918, and it was stated that theoretical conclusions were confirmed by practice. It was, perhaps, hardly worth while elaborating the construction of locomotives to obtain a high centre of gravity. The centre of gravity depended principally upon the general construction of the locomotive; there was little gain in placing the motors above the centre line of the locomotive.

Mr. H. N. GRESLEY (London and North-Eastern Railway) wished to know if the French power companies had statutory areas, as in England, and how conditions in this respect compared with English conditions. In England the electrification of railways had not been made the most of. The load factor in crowded suburban areas was extremely poor owing to the fact that a large number of trains were required for comparatively short periods. If the area was extended for 40 or 50 miles the load factor would be greatly improved, as freight trains could then be worked electrically. The speaker discussed the question of the price of power. He said that there was a strong case for the generation of their own power by the railway companies. By the present arrangement the railway companies were bound to the power companies for a number of years without the hope of a decrease in charges apart from the small benefits afforded by coal clauses, &c. The railway companies could raise money much more cheaply for the erection of power stations owing to the nature of the securities they were able to offer debenture holders. As an alternative it might be possible for the two parties to make some sort of co-operative arrangement giving the railway companies some voice in management.

Mr. R. L. MORRISON (Power Rectifiers, Ltd.) said that it was a good testimonial for mercury arc rectifiers that they were installed where the load was severest. Rectifiers to deal with pressures up to 1,800 V were used. Their principal advantage was their ability to carry very heavy short-period overloads. By means of lantern slides Mr. Morrison described the type of high-speed circuit breaker employed, and showed illustrations of short-circuit tests. He also exhibited curves showing the efficiency of rectifiers at various loads, and a time-current curve showing the ability of the rectifier to withstand overloads.

Mr. A. T. DOVER (Battersea Polytechnic) asked a number of questions as to the comparative efficiencies of converter and rectifier sub-stations and the staff required for each; and if the ripple in the rectified current caused any trouble in the motors. He considered that the power of 70 kW for the auxiliaries was rather large.

Mr. C. E. FAIRBURN (English Electric Co.) explained that Mr. Bachellery did not intend to convey that regenerative braking was not feasible; it was just that it was not suitable for that particular railway. The main reason for this was the use of rectifiers. Regenerated energy had to go back to the converters, sometimes a very long distance. He illustrated by lantern slides the system of regenerative braking developed by the English Electric Co., Ltd., and showed the results obtained at various speeds. He stated that no spring drive was employed; it was obviated by carefully lining up the motors.

Mr. G. W. PARTRIDGE (London Electric Supply Corporation) asked whether, in speaking of high-speed circuit breakers, the author meant that the circuit was opened quickly, the moment the circuit breaker commenced to start, or did it mean that the circuit was opened instantaneously. His reason for asking this question was that if circuit breakers acted instantaneously, it might be that various sections of a railway would be shut down from time to time. From his experience with supply to suburban lines, if the circuit breakers opened every time there was a short circuit he was afraid it would have a very bad effect on the supply. In taking a supply from the general power stations, as in the case of France, he could foresee certain difficulties such as a heavy demand by the railway upsetting the regulation or causing drops in pressure on the commercial supply. On the other hand, drops in pressure, within moderation, due to the commercial supply, would not have any effect upon the railways. Had the author considered apparatus which would keep down the maximum demand or limit it in certain districts? He did not know what system of charging was being made by the supply authorities to the railways, but if it were on the basis of a charge per kW, and then a further charge per kWh, the lower the maximum demand could be kept the better. He believed this system had been tried in America with some success. He could not sit down without commenting upon the remarks of Mr. Gresley, who seemed to think—as a good many other people did—that supply rates were too high. From his experience, however, he found that the charges for current were somewhere near pre-war rates, and he would like to ask Mr. Gresley how the railway companies' charges compared to-day with pre-war. He believed they were anything from 50 to 100 per cent. above pre-war rates. He could conceive that under certain conditions it might be to the advantage of a railway company to own its power station, but as, owing to the diversity factor,

a power company or similar authority was able to generate at much lower rates, he could not conceive that a railway company, with only its own load, could generate as cheaply. The time would come when other users than railways would be supplied at lower rates than the railway companies, and he could assure Mr. Gresley that in making a contract with a supply authority, in which, as was often the case, the railway company had a clause giving it the benefit of any improvement in the art, so long as it was prepared to pay a reasonable interest on the capital expended, he would be quite safe. There was also often a clause that the rates should be revised every 10 years. In these circumstances, Mr. Gresley would be well advised to leave the supply of electricity in the hands of those who really understood that job and give all his attention to reducing the railway charges.

The President brought the discussion to a close by moving a hearty vote of thanks to M. Bachellery and those who had taken part in the discussion.

## EXPORTS AND IMPORTS OF ELECTRICAL GOODS AND MACHINERY IN DECEMBER, 1923.

THE export figures for last month are notable for the great advance which they show both in comparison with the previous month's figures and those of December, 1922. Roughly, the increase may be said to be due to a greater export of submarine telegraph and telephone cable. The increases and decreases in the other items practically cancel one another out. It is noteworthy that under only one heading is a decrease from the December, 1922, totals shown, viz., switchboards (not telegraph or telephone). The imports showed a 14 per cent. decrease as compared with the previous month, but in comparison with the December, 1922, figures, they were some 20 per cent. greater. Meters and instruments, and telegraph and telephone wires and cables showed notable decreases. The most prominent alterations in comparison with December, 1922, were a large increase in telegraph and telephone instruments and apparatus, and a decrease in imported glow lamps.

Turning to the lower table which compares the whole of the years 1922 and 1923, it is to be seen that the increase in exports was in the region of 20 per cent.—a very satisfactory showing. There was a similar increase in imports, but there is a very large balance in favour of the industry. The increase in re-exports was not abnormal. The most striking increase in exports occurred under the heading of submarine cables; this is but a reflection of the large December exports to which reference has been made above. Apart from this there were notable advances in the values of exported railway and tramway motors, unenumerated electrical goods and apparatus, and telegraph and telephone wires and cable. The principal (percentage) decrease occurred under the heading "Switchboards (not telegraph or telephone)." Only two of the import items showed decreases, viz., unenumerated electrical machinery and switchboards.

| | Exports. | | | Imports. | | | Re-Exports. | | |
|---|---|---|---|---|---|---|---|---|---|
| | Electrical exports for Dec. 1923. | Inc. or dec. as compared with Nov., 1923. | Inc. or dec. as compared with Dec., 1922. | Electrical imports for Dec., 1923. | Inc. or dec. as compared with Nov., 1923. | Inc. or dec. as compared with Dec., 1922. | Electrical re-exports for Dec., 1923. | Inc. or dec. as compared with Nov., 1923. | Inc. or dec. as compared with Dec., 1922. |
| Electrical goods and apparatus (unenumerated) ... ... | £151,042 | − £10,583 | + £49,820 | £84,674 | − £2,881 | + £12,127 | £4,152 | − £534 | + £600 |
| Insulated wires and cables ... | 187,906 | − 11,528 | + 1,761 | 31,777 | + 6,977 | + 5,440 | 394 | + 344 | + 340 |
| Glow lamps ... ... ... | 28,917 | + 3,755 | + 7,171 | 26,372 | + 877 | − 13,867 | 339 | − 26 | − 141 |
| Arc lamps and parts ... ... | 1,272 | + 289 | + 882 | 2,684 | + 1,491 | + 1,862 | 13 | − 448 | + 13 |
| Batteries and accumulators ... | 56,882 | − 5,148 | + 16,373 | 15,055 | − 3,922 | − 1,733 | 190 | − 390 | + 15 |
| Meters and instruments ... | 34,013 | + 1,016 | + 3,422 | 8,847 | − 7,464 | + 2,115 | 1,575 | + 1,013 | + 1,296 |
| Carbons ... ... ... ... | 3,153 | − 1,713 | + 2,017 | 9,905 | − 5,150 | + 1,302 | 87 | − 278 | − 157 |
| *Electrical Machinery—* | | | | | | | | | |
| Electrical machinery (unenumerated) ... ... ... | 189,228 | + 1,639 | + 26,954 | 79,667 | − 1,565 | + 21,591 | 7,664 | − 7,696 | − 2,121 |
| Railway and tramway motors | 40,123 | + 3,711 | + 11,867 | — | — | — | — | — | — |
| Other motors and generators ... | 182,590 | − 10,263 | + 46,171 | — | — | — | — | — | — |
| Switchboards (not telegraph or telephone) ... ... | 4,900 | − 579 | − 2,702 | 113 | + 113 | − 142 | — | — | — |
| *Telegraph and Telephone Cable and Material—* | | | | | | | | | |
| Telegraph and telephone wires and cable (not submarine) | 66,729 | + 11,401 | + 31,091 | 4,080 | − 5,297 | − 2,945 | 5 | − 28 | + 5 |
| Submarine telegraph and telephone cable ... ... ... | 1,914,214 | + 1,895,972 | + 1,850,618 | — | — | — | — | — | — |
| Telegraph and telephone instruments and apparatus ... | 182,283 | + 25,707 | + 96,468 | 50,902 | − 6,950 | + 25,692 | 5,358 | + 4,784 | + 3,271 |
| Totals ... ... | £3,043,252 | + £1,903,676 | + £2,141,943 | £314,076 | − £23,771 | + £51,442 | £19,777 | − £3,259 | + £3,130 |

### Values of Electrical Exports, Imports, and Re-exports for 1922 and 1923, compared.

| | Exports. | | | Imports. | | | Re-exports. | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1922. | 1923. | Inc. or dec. | 1922. | 1923. | Inc. or dec. | 1922. | 1923. | Inc. or dec. |
| Elecl. goods and apparatus (unenumerated) ... | £1,261,067 | £1,536,589 | + £275,522 | £541,276 | £874,088 | + £332,812 | £15,857 | £50,673 | + £4,816 |
| Insulated wires and cables | 1,796,141 | 2,035,145 | + 239,004 | 216,155 | 287,466 | + 71,311 | 1,452 | 3,179 | + 1,727 |
| Glow lamps... ... ... | 362,640 | 338,485 | − 24,155 | 212,975 | 218,876 | + 5,901 | 55,302 | 6,548 | − 48,754 |
| Arc lamps and parts ... | 12,404 | 10,473 | − 1,931 | 13,199 | 17,900 | + 4,701 | 1,796 | 1,403 | − 393 |
| Batteries and accumulators | 482,640 | 558,919 | + 76,279 | 131,446 | 154,068 | + 22,622 | 3,882 | 4,031 | + 149 |
| Meters and instruments ... | 339,183 | 348,790 | + 9,607 | 68,616 | 102,775 | + 34,159 | 10,447 | 8,065 | − 2,382 |
| Carbons ... ... ... | 52,268 | 66,665 | + 14,397 | 46,269 | 92,218 | + 45,949 | 4,146 | 2,670 | − 1,476 |
| *Electrical machinery—* | | | | | | | | | |
| Electrical machinery (unenumerated) ... ... | 1,862,218 | 1,676,225 | − 185,993 | 1,158,653 | 1,015,637 | − 143,016 | 55,339 | 109,530 | + 54,191 |
| Railway & tramway motors | 203,828 | 351,485 | + 147,657 | — | — | — | — | — | — |
| Other motors and generators | 2,078,576 | 1,923,435 | − 155,141 | — | — | — | — | — | — |
| Switchboards (not telegraph or telephone) ... | 209,138 | 102,639 | − 106,499 | 2,806 | 2,040 | − 766 | 72 | 1,297 | + 1,225 |
| *Telegraph and Telephone Cable and Material.—* | | | | | | | | | |
| Telegraph and telephone wires and cable (not submarine) ... ... ... | 557,391 | 859,218 | + 301,827 | 34,878 | 85,863 | + 50,985 | 2,033 | 3,979 | + 1,946 |
| Submarine telegraph and telephone cable ... ... | 403,023 | 2,530,610 | + 2,127,587 | — | — | — | — | 4 | + 4 |
| Telegraph and telephone instruments and apparatus... | 1,841,935 | 1,838,991 | − 2,944 | 285,106 | 552,251 | + 267,145 | 25,857 | 22,179 | − 3,678 |
| Totals ... ... | £11,462,452 | £14,177,669 | + £2,715,217 | £2,711,379 | £3,403,182 | + £691,803 | £206,223 | £213,558 | + £7,375 |

# Promoting Retail Electrical Sales.

AT a salesmanship conference held under the auspices of the British Electrical Development Association at Newcastle-upon-Tyne, on December 13th last, Mr. H. W. ROBERTS (General Electric Co., Ltd.) read his paper on "How to organise and promote retail showroom sales," which was abstracted in our issue of October 26th last (p. 610). Mr. W. Horsfall took the chair and the reading of the paper was followed by a discussion, the principal points of which are dealt with below.

Mr. ALLEN said that the question of the price of electricity must be put to the consumer in simple terms; he should not be worried with the technique of the matter. He was in favour of the employment of women in selling domestic apparatus, but whether men or women were employed they should be thoroughly trained for their duties. Salesmen should be paid commission on the basis of the selling price. Commission on profits led to suspicion and dissatisfaction. In reviewing the progress of electricty in the United States it was to be borne in mind that there electricity competed on level terms with gas, and, indeed, it often had the field to itself. Where an industry had not to face entrenched interests more money could be spent in development with hope of success. The electrical authorities in this country might do much more, however, and they should first turn their attention to methods of charging; the present system of two or three rates for lighting, power, and heating was a great handicap. The provision of wall plugs when a building was being wired was very important, but wall plugs should be properly standardised.

Mr. EDGAR (South Shields) said that the industrial power side could look after itself; it was the domestic branch that needed "pushing." The cost of wiring a house (twenty or thirty pounds) was a large expense, especially when, as had happened in South Shields, a gas company offered to equip an eight-roomed house for five guineas. Much good was done by municipal authorities by means of periodical exhibitions of domestic apparatus. He (Mr. Edgar) had proved by actual experiment that co-operative advertising was extraordinarily beneficial to an undertaking. In conclusion, he suggested that the question of tariffs, a large question, might be discussed at a later meeting, to be devoted to that subject alone.

Mr. CROSS said that assistants should be conversant with rates of charge, the position of mains, and the condition of loading. The question of cost was not the most important thing; it was the business of the salesman to make a prospective consumer require an appliance so much that price assumed a secondary position. The author of the paper had said that assistants should keep in touch with all apparatus. This was not essential if the principal or someone in authority carefully decided which appliances were the best for his customers. He did not like the idea of a house-to-house canvass; in his district people were not fond of hawkers or casual callers. In America the electricity suppliers were subsidising contractors to put in extra heating points; something of this sort might be done in this country. The hire-purchase system was eminently suitable for cookers because the sale of energy for them amply covered maintenance.

Mr. ELLIS was of the opinion that the value of electrical apparatus in terms of money should be emphasised. In canvassing for further business the supplier should state the approximate cost of an installation. Salesmen should be paid adequate salaries rather than commission; the right type of man would be secured in this way.

Mr. KILLEY did not consider as sound the "sale or return" policy. Electrical appliances should be made "fashionable," and they would immediately have a vogue. The competition of large stores was often harmful to the industry, for they often supplied foreign goods, for which spares for replacement were not obtainable. Specialisation was not possible for the small retailer—he had to know as much as possible about everything he handled.

The CHAIRMAN said that restrictive legislation and timidity on the part of manufacturers and contractors had militated against progress, but there were signs of a great improvement. He welcomed the advent of the Electricty Commissioners, as they had a sound policy, and were not likely to impose harmful restrictions. There would in future be more co-operation, and the standardisation of supply pressures was as important as the standardisation of plugs. There was a necessity for more foresight in the laying of mains if progress was to be made. The subsidisation of the contractor to cheapen installations was worth considering.

In reply to the discussion Mr. ROBERTS said that he exemplified American conditions as an effort to promote enthusiasm. As regarded the payment of commission to salesmen, he favoured pooling and sharing, but individual sales should also be recognised. The wall plug had been standardised but the trouble was that the standard plug was not used. He considered that the stability of the industry depended not so much on the "pushing" of appliances by central stations as the sale of appliances by contractors. When he spoke of house-to-house canvassing he did not necessarily mean personal calls, or making meter readers salesmen; he was referring to a canvass by post in the first place. Many large businesses had been built up in that way.

# Reviews.

**A Treatise on Electro-Metallurgy.** By WALTER G. MCMILLAN. Revised by W. R. COOPER, M.A., B.Sc., A.I.C. 4th Edition. Pp. xv + 449. Figs. 128 (Griffin's Scientific Textbooks). London: C. Griffin and Co., Ltd. Price: 21s. net.

The volume under review is a standard treatise on the subject, and embraces the application of electrolysis to the plating, depositing, smelting, and the refining of various metals, and the reproduction of printing surfaces and art work generally. The book is divided into 20 sections, viz.:—(1) Introduction and historical. (2) Theoretical and general. (3) Sources of current. (4) General conditions of electroplating. (5) Plating adjuncts and disposition of plant. (6) Cleansing and polishing of plated goods. (7) Electro-deposition of copper. (8) Electro-typing. (9) Electro-deposition of silver. (10) Electro-deposition of gold. (11) Of nickel and cobalt. (12) Of iron. (13) Of platinum, zinc, chromium, cadmium, tin, lead, antimony, bismuth, palladium. (14) Of alloys. (15) Electro-metallurgical processes. (16) Recovery of metals. (17) Determination of metals in solutions. (18) Power required. (19) Modern theories of electrolysis. (20) Glossary of substances. Addenda. Index.

The volume first appeared in 1890, and has now reached a fourth edition, the third edition having been out of print since 1919.

Within recent years the electrolytic processes for the treatment of particular metals have undergone considerable changes in their industrial application, necessitating a thorough revision, and the introduction of much additional matter and new illustrations into this treatise.

The developments in electro-metallurgy of late years have been more in the direction of the improvement and refinement of the existing processes than in the application of new principles.

Electric welding processes have been omitted from the fourth edition, being considered outside the scope of the book, and the short account of the application of the electric furnace to iron and steel is almost unchanged from the third edition.

Since the electro-metallurgy of iron has made such vast progress since the last publication of the volume, and possesses a literature of its own, we think that this section might well have been abandoned, being adequately provided for in treatises devoted entirely to that subject. The short note at the end of Chapter 12 on the electro-deposition of iron is somewhat belated in its reference to the building up of the worn parts of machinery by means of this metal. During revision, the fact has been overlooked that nickel is much more serviceable, easier of application, and now in general use industrially, having almost entirely displaced iron for this purpose. In a future edition space might be found in the section on nickel and cobalt, for a description of the industrial processes used for the building up of worn parts of machinery by nickel deposition methods.

The revision of the book has been again entrusted to Mr. W. R. Cooper, who has carried out the work with discrimination in a most capable and admirable manner, and "with loyalty to the intentions of the original writer."

With the exception of Chapter 15, which is on "Electro-Metallurgical Extraction and Refining Processes," the work deals more particularly with electro-depositing and plating in all its phases. Since the publication of the third edition vast and important strides have been made in those electro-metallurgical processes, which experienced considerable impetus under war-time exigencies. The electrolytic extraction and smelting of zinc and the deposition of cobalt by electrolytic processes have made outstanding advances in recent years, and such matter has found prominence in this volume. Chapter 11 contains an able summary of the results of the recent work conducted on the electrolytic deposition of cobalt, particularly the classic researches of Harper and Savell.

The section devoted to the electrolytic refining of copper has been extended, a large amount of additional matter has been introduced, particularly in connection with specialised processes for electrolytic deposition and refining, and the practical aspects and developments of copper electro-plating.

Chapter 15 admirably summarises methods for the electrolytic extraction of zinc. Reference is made to American electrolytic zinc works, but none to the Australian electrolytic zinc works at Hobart, Australia, which is the largest and most modern plant in the world, being capable of producing 110 tons of zinc per day.

Pages 387-413 contain a glossary of substances commonly employed in electro-metallurgy with a short account of their properties; pages 414-428 are an addendum to Chapter 20, consisting of serviceable tables. A short account of methods for the bronzing of copper and brass surfaces is also included.

The matter treated is extensive, and shows vividly the rapidity of present-day developments in the industrial applications of electrolysis to metallurgical processes. The volume in its present form is a standard work on the subject, a sound and valuable textbook for students, and a highly practical guide book for electro-metallurgists. It is an informative reference book for all engaged in the electrolytic treatment of

metals, and appears to the reviewer to be a model of concentration and can be highly recommended.

As is customary with books published by Messrs. Griffin and Co., the volume is well printed and produced, and adequately indexed. E. L.

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**The Poulsen Arc Generator.** By C. F. ELWELL, B.A., E.E. (Stamford). Pp. 192; figs. 150. London: Ernest Benn, Ltd. Price 18s. net.

This is the first book published on the arc system of wireless transmission, and is written by one of the foremost authorities on its practical application. It will, therefore, be especially welcomed by those wireless engineers who are working at this particular form of transmission.

Mr. Elwell has not attempted to write an exhaustive treatise but has preferred to give us an excellent, profusely illustrated outline of arc practice, with references to a bibliography of 127 papers. Anyone with this book, and access to a good technical library, can readily make himself acquainted with all that has been published on the subject, under the guidance of an engineer who has probably done more than anyone else to adapt its theory to commercial practice.

Mr. Elwell goes all out to show the prominent position held at the present time by the arc as a radio transmitter, and mentions 78 arc stations with an input of from 25 to 1,000 kW. Here he is on safe ground, but as to future developments his opinions are, as he says, "no more unbiased than those of the vested interests of various kinds which spend so much energy in disclaiming the arc." He looks squarely at the past and the present, and if he did the same at the future he could not fail to see that developments in radio transmission will be little concerned with any further developments in the poulsen arc generator.

The production of the book, as might be expected from its price, is first class.

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**Engineering Science.** By ARTHUR G. ROBSON, A.M.I.M.E. Pp. xii+201; figs. 185. London: Chapman & Hall, Ltd. Price 7s. 6d. net.

This little book forms one of the publishers' well-known "Directly Useful" series of technical books which have been produced with the object of filling the gap which has hitherto existed between the theoretical text-book written for the technical college and university student, and the practical treatise which is suitable only for those with a deep knowledge and a wide experience of their subject. There are many young engineers who have not had the advantage of a lengthy technical college education, but who are sufficiently ambitious to desire to improve their technical knowledge by working at evening classes and at home. For them this series has been developed, and of the many excellent books in the series which we have had the pleasure of examining, this is certainly one of the most useful. The subject, "Engineering Science," is one which has been only recently developed, but it may be regarded as comprising the fundamental parts of mechanical engineering, including mechanics, hydraulics, heat, and heat engines. It will be apparent that within the compass of a book of 200 pages it is impossible to deal with any of these subjects at great length, but the author has succeeded in dealing with the more important parts of each subject in such a way that the reader obtains a good idea of the principles which together unite to form the basis of engineering science. We were particularly struck with those chapters dealing with Work and Power, Energy and the Transformation of Energy, and Heat Engines, and we venture to suggest that in a future edition these might be placed at the beginning of the book rather than the more theoretical—and less essential from the practical engineer's point of view—chapter on Vectors. Again, we should have liked to have seen the chapter on Hydraulics developed to rather greater length, so as to include some elementary ideas on water-power turbines. This should not prove beyond the standard of the reader who has studied the earlier chapters where velocities, &c., have been dealt with. So, too, we think that a chapter might have been included dealing with the elements of practical electricity. The idea of electrical horse-power is indeed mentioned, but in view of the part which electricity plays in every engineering establishment, some rather fuller treatment is obviously called for in a work on engineering science. Within the scope of the syllabus laid down by the Board of Education, this book admirably fulfils its purpose, and we can have nothing but praise for the simple and lucid manner in which the various subjects are treated. Throughout there has obviously been a conscious endeavour to bring the theory into line with the practical side of engineering, and, wherever possible, the application of the subject matter to actual engineering problems is demonstrated. A number of numerical exercises are worked out in the text, and others with the answers are given at the conclusion of the various chapters. This book can be thoroughly recommended not only to those who stand upon the threshold of their study of the theoretical sciences upon which engineering has been built up, but also to those who would like to revise in a quick and efficient manner their elementary knowledge of these sciences.

1. **Electrical Cranes and Hauling Machines.** By F. E. CHILTON, A.M.I.E.E. Pp. x+114; figs. 49.
2. **Electrical Insulation.** By W. S. FLIGHT, A.M.I.E.E. Pp. xi+107; figs. 55.
3. **Small Electric Motors.** By E. T. PAINTON, B.Sc. (Eng.), Lond. Pp. xi+120; figs. 55.

London: Sir Isaac Pitman & Sons, Ltd. Price 2s. 6d. net each volume.

Messrs. Pitman appear to be trying to realise the technical section of Carlyle's book "University," and the above volumes are recent additions to the well-known Pitman's Technical Primers. Each volume is written by a specialist, and gives in concise form the essentials of the subject from which it derives its title. The books are of very handy size and are well printed and bound. If suitably grouped, a series of these volumes would provide a very useful adjunct to a technical college course, since modern applications are always given. Their scope may be gathered from the following brief reviews of the above-mentioned works.

1. *Electrical Cranes.*—Mr. Chilton describes very briefly the construction and operation of cranes, transporters, capstans, winches, haulage and winding gear. Most of the illustrations are merely photographs which, although very interesting, cannot be said to have much value to anyone who requires intimate knowledge of the construction of crane structures. Adequate notes on the strength of girders and ropes are included; these are somewhat marred by the author's making the common error of confusing "stress" with "strain." (Cp. table 1, p. 69.) The electrical equipment of cranes and winches is dealt with in a very general way. This part would be greatly improved by a few detailed wiring diagrams for a.c. and d.c. systems.

2. *Electrical Insulation.*—There has been a very definite need for a modern book on this subject, as most of the available literature is in the form of papers given before various scientific bodies, such as the Institution of Electrical Engineers. Mr. Flight has summarised most of the available empirical data on insulation in a very convenient manner. The chief sections of the book are Classification of Insulating Materials; Absorbent, Non-Absorbent, and Liquid Materials; Factors Influencing Electric Strength; Insulation Testing; Insulation of Medium- and High-Voltage Machines; Sparking Distances in Air and Oil. The illustrations consist for the most part of graphs and line diagrams; they are, however, almost all of a very useful nature. A very complete and useful bibliography is included; this alone is worth the money charged for the volume. Mr. Flight's book should be read by every electrical engineer.

3. *Small Electric Motors.*—This book deals with the theory and construction of fractional horse-power motors. The working principles of both a.c. and d.c. machines are described in a very clear and interesting manner. The illustrations are very good, especially those dealing with commutation and armature windings. Mr. Painton has done his work most thoroughly, and it is be hoped that his volume will be more widely read than the reviewer anticipates.

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# Published Specifications.

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS, Patent Agents.

The name of the applicant's patent agent, if any, will be found on the printed specification.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

## 1923.

22,113. "Head lamps for automobiles and other vehicles." A. S. Ward. May 14th, 1923. (208,574.)

22,525. "Electric governor for prime movers." A. H. Railing, M. L. Kaiser, and R. G. Jakeman. August 18th, 1922. (208,577.)

24,975. "Sound-reproducing machines." H. T. Barnett. September 16th, 1922. (208,580.)

25,352. "Time-limit electric relays." Akt. Ges. Brown, Boveri et Cie. October 19th, 1921. (Addition to 14,498/15.) (187,585.)

25,583. "Terminal for electrical apparatus." Igranic Electric Co., Ltd., and A. H. Curtis. September 21st, 1922. (208,597.)

25,621. "Variable electric condensers." F. K. Crowther and Radio Communication Co., Ltd. September 21st, 1922. (208,598.)

27,700. "Electric insulators comprising fuses." B. G. C. Stephens. October 18th, 1921. (187,597.)

28,556. "Gas and electricity meters and the like." P. F. E. Major, G. H. Miles, and C. C. Smith. October 20th, 1922. (208,615.)

35,508. "Electric fire-alarms." A. H. Edwards. December 30th, 1922. (208,645.)

## 1923.

1,007. "Process and apparatus for electrolysing fused salts of metals, and recovering the metals and acid radicles, and the application of the said process and apparatus to the recovery of valuable constituents from the metal-bearing ores and materials." E. A. Ashcroft. January 11th, 1923. (Cognate application 3,789/23.) (Addition to 198,024.) (208,649.)

4,952. "Inductance coil mountings." Pacent Electric Co. Inc. July 26th, 1922. (201,136.)

5,219. "Insulators, and methods of making the same." British Thomson-Houston Co., Ltd. (General Electric Co.) February 22nd, 1923. (208,667.)

10,694. "Platforms or skid-plates for use with light railways, tramways, and the like." L. L. L. Mathew. April 19th, 1923. (208,674.)

11,332. "Process for the automatic connection of an installation equipped with large mercury vapour rectifiers." Akt. Ges. Brown, Boveri et Cie. May 26th, 1922. (198,347.)

11,426. "Regulating devices for electrical apparatus." Aktiebolaget Birka Regulator. September 1st, 1922. (203,292.)

22,934. "Production of articles of quartz." British Thomson-Houston Co., Ltd. (General Electric Co.). September 12th, 1923. (208,682.)